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THESIS

THE FUNDAMENTAL RE-THINKING AND REDESIGN
OF THE MILITARY PAY DOCUMENT PROCESSING
SYSTEM

by

Eric F. Zellars
Cornell I. Perry

March 1999

Thesis Advisor:	Mark E. Nissen
Associate Advisor:	John Osmundson

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13. ABSTRACT *(maximum 200 words)*

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THE FUNDAMENTAL RE-THINKING AND REDESIGN OF THE MILITARY PAY DOCUMENT PROCESSING SYSTEM

Eric F. Zellars
Captain, United States Army
B.S., Florida Agricultural and Mechanical University, 1989

Cornell I. Perry
Lieutenant., United States Coast Guard
B.S., Prairie View Agricultural and Mechanical University, 1992

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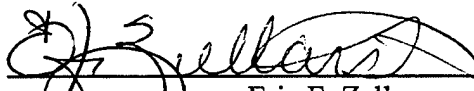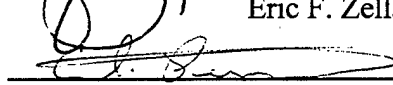requirements for the degree of

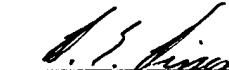## MASTER OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT

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March 1999

Authors: _____
Eric F. Zellars

_____
Cornell I. Perry

Approved by: _____
Mark E. Nissen, Thesis Advisor

_____
John Osmundson, Associate Advisor

_____ _____
Dan Boger, Chairman   Reuben Harris, Chairman
Information Systems Academic   Department of Systems Management
Group

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ABSTRACT

All organizations, both private and public, must improve, streamline, and automate their business practices to adjust to rigorous demands of a highly volatile marketplace, austere financial resources, and manpower reductions. This thesis analyzes the potential of business process reengineering (BPR) to dramatically improve the Military Pay Document Process (MPDP) for the United States Army and the United States Coast Guard financial communities. Based on Nissen's methodology the MPDP is analyzed and three redesign alternatives are developed, which are capable of yielding order of magnitude improvements in cycle time and cost. This thesis includes process simulation and intelligent systems analysis of the Army and Coast Guard's baseline MPDP to generate and evaluate the three redesign alternatives. Simulation runs demonstrate that cycle time and cost can be reduced substantially by redesigning the MPDP. The redesign alternatives take a comprehensive look at transformation enablers and information technology (IT) capable of eliminating the Personnel Administrative Clerks (PAC) and the finance office functions as they pertain to pay transaction processing. The research concludes that the Army and Coast Guard's MPDP can be dramatically improved by eliminating middlemen functions (PAC and finance office) and shortening the value chain using IT along with other transformation enablers.

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I. INTRODUCTION

Chapter I discusses the purpose and content of this thesis. It also provides a brief overview of the background and objectives of the research, questions answered, and the methodology used.

A. BACKGROUND

As the Department of Defense (DOD) and the Department of Transportation (DOT) are pushed to cut spending through downsizing and restructuring, the need to redesign existing military processes seems inevitable. Recent government initiatives provide strong incentives for federal agencies to improve the services they provide to the public, with greater accountability for achieving results quicker and at lower cost. The 1993 Government Performance and Results Act establishes expectations for agencies to plan strategically and achieve better mission outcomes. The "Contract With America", with its inherent budget and personnel reductions, encourages federal agencies to find ways to work more efficiently and effectively. In addition, the Administration's National Performance Review requires that federal agencies establish customer service standards and focus efforts on improving the value of government services to the public. [Al Gore, 1993]

In line with these initiatives, the Assistant Secretary of the Army for Financial Management (ASA-FM) announced in a Personnel Leader's Meeting in Columbia, South Carolina on April 2, 1998 that she would use five broad categories as a framework to communicate a variety of initiatives. The ASA-FM notes that, "Maximizing information technology is critical to the success of DOD reengineering efforts." [Helen T. McCoy, 1998] To this end the Defense Finance and Accounting Service Indianapolis (DFAS-IN) is preparing to test and release a kiosk terminal and eventually a web based application that will allow service members to access their Leave and Earnings Statements (LES), change allotments, and even change their tax withholdings options. The infusion of new and advanced technology will dramatically change how finance processes military pay documents.

B. OBJECTIVES

The goal of our research is to dramatically improve critical measures of process performance which we define as cost, customer service, and document cycle time in both the Army and Coast Guard. We do this by redesigning the Military Pay Document Process of the Army and Coast Guard.

The Military Pay Document Process (MPDP) as we define it is the process in which the soldier or sailor can make amendments or changes to his or her Master Military Pay Account (MMPA). Some examples of affected transactions include the start and stop of allotments for U.S. Savings bonds or Life Insurance policies, change to tax exemption status, change of financial institution or Direct Deposits, and change to employee withholding allowance. The bottom-line is that the customer (soldier/sailor) controls the pay items just mentioned. They can only be initiated by the soldier/sailor and have a direct impact on the soldiers'/sailors' MMPA and take home pay.

C. RESEARCH QUESTIONS

This research is focused on answering a primary question "How can the Military Pay Document Process be redesigned to improve critical measures of performance?" In order to answer this question a set of sub-questions is focused on and answered:

- What is the current MPDP?
- What pathologies and problems can be observed in the Army and Coast Guard MPDP?
- How can the MPDP be improved and what are the expected performance benefits?
- What are the MPDP service goals established by the Army and Coast Guard?
- How can Business Process Redesign (BPR) help the Army and the Coast Guard dramatically improve the MPDP?
- What is the most effective MPDP for the Army and the Coast Guard finance communities?

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D. SCOPE OF THESIS

The scope of this thesis includes an overview of the current Military Pay Document Processing Procedures and technology, as well as the existing goals of the Army and the Coast Guard financial communities. Current initiatives to redesign the Military Pay Document Processing process are examined along with analyzing existing pathologies and problems with current customer service. This information assists in the redesign of the MPDP to improve critical performance measures for the Army and the Coast Guard.

E. RESEARCH METHODOLGY

The research techniques used for this thesis include a thorough literature review of the following topics: Business Process Reengineering, Military Pay Document Process, Department of Defense Financial Management, and the Department of Transportation General Guidelines for customer service. A review of selected Army and Coast Guard units' Standard Operating Procedures is completed, surveys are administered, and personal interviews are conducted with soldiers and sailors. The authors use Extend + BPR software to model and simulate the MPDP. We first model the baseline process of the MPDP, diagnosing process pathologies and faults, and then generate redesign alternatives.

F. CHAPTER OUTLINE

This thesis is organized as follows. Chapter II provides background information on the evolution of the Military Pay System (MPS) processes, and Business Process Reengineering. Chapter III discusses the tools used to develop, analyze and redesign the current Military Pay Document Process. Using these tools, the authors model the baseline process, analyze process pathologies and measure the components and performance of the MPDP. Chapter IV generates redesign alternatives, models these alternatives, and analyzes the new process based on the critical measures of performance. Chapter V concludes with recommendations, and future research topics.

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II. BACKGROUND

The mission of the Army and the Coast Guard (CG) finance community is to provide military pay support for active duty, reserve, and retired soldiers and sailors who assist Commanders in accomplishing their mission. These organizations are also responsible for the computation and disbursement of travel allowances, payment of commercial vendors, and disbursement of public funds necessary to support the presence of the United States Army and the United States Coast Guard in foreign areas. As one can see, the responsibilities of these two organizations are diverse and immense. One of the most important missions for both financial organizations is military pay support for active duty soldiers and sailors in the Department of Defense (DOD) and the Department of Transportation (DOT) respectively. To accomplish this mission DOD and DOT have increased the level of automation to speed up the processes involved in performing military pay transactions. Although automation has improved the Military Pay Document Process (MPDP) for the Army and the CG, little has been done to reengineer the processes associated with the MPDP.

The need for reengineering the Military Pay Document Process to reduce cost and cycle-time, and increase customer satisfaction, has never been greater. We can't continue to embrace the Adam Smith theory that says people are most efficient when they have only one easily understood task to perform. Hammer (1993) points out that simple tasks demand complex processes to knit them all together, and for many years corporations and government agencies have accepted the inconvenience, inefficiencies, and costs associated with complex processes in order to reap the benefits of simple tasks. This way of thinking is predicated on the Industrial Revolution, when specialization of labor and economy of scale promised to overcome inefficiencies of the cottage industries. [Hammer and Champy, 1993]

Most of the processes used by the Army and the CG were developed before modern computers and communication systems existed. As the Army and CG financial systems aged, processes (both documented and undocumented) evolved to deal with the situations encountered. Instead of being designed using a structured approach, the process mutated to what we define as the baseline Military Pay Document Process.

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A. MILITARY PAY AND ALLOWANCES

The process of paying soldiers and sailors has a rich history and interesting evolution. By examining the history and the evolution of the Military Pay Document Process, we can observe and note the impact technology has on these processes, while examining how the processes have changed in light of technological advances. Here we show that technology has increased the speed and accuracy, and in some cases the flexibility, of making pay changes for soldiers and sailors; however the process associated with making pay changes has changed very little, if at all, in the last century.

The current information age has not had the expected impact on process innovations, since applying technology has typically meant merely automating or speeding up existing processes. Two fundamental problems exist when this happens. The first is while processes might have been improved, they were never engineered to begin with. Secondly, continuously improving existing processes simply means that one's often doing better what should never have been done at all. [Diamond, 1998]

1. Evolution of the Military Pay Document Process

The U.S. Army Finance Corps originated on June 16, 1775, when the Second Continental Congress introduced a resolution appointing James Warren as the first Paymaster General for the Army. In 1775 a captain received $20, a lieutenant $13, a sergeant $8, and a private $6 each month. The process of paying soldiers required the Paymaster at Army Headquarters to compute monthly payrolls in his office and then he went to the field with his "box" of gold and a military guard to pay the soldiers. Obviously payday was not the 1st and 15th day of each month, as we know it today. Furthermore, soldiers received no additional entitlements or allowances and had no control over how their pay was dispersed or allotted. In a second resolution on 22 June 1775, congress required General Warren to pay all troops of the army on a monthly basis. This ambitious requirement took more than 100 years before it could be performed consistently.

Since then the Army has used more modern methods for paying and making pay changes to soldiers' pay accounts. Over the past five decades, the Army has implemented four primary pay systems to perform its mission. These four systems include the Finance

Document Record Folder (FDRF) System, Joint Uniform Military Pay System (JUMPS), Jumps Automated Coding System (JACS), and the Defense Joint Military Pay System (DJMS). Each system and the MPDP associated with it are discussed in the following paragraphs.

The Finance Document Record Folder System was implemented in the early 1900's. This was a manual system that required each finance office to maintain a folder for each soldier that was assigned to a particular installation. This folder contained all the financial transactions that were processed by the finance office for a soldier. The information contained in this folder was used to compute soldiers' pay at the end of each month.

The Military Pay Document Process used the FDRF system: If a soldier wanted to make a change to his account he would report to his Military Personnel Office (Milpo) and retrieve the necessary documentation. After the soldier completed the documentation, he returned it to the Milpo clerk. The Milpo clerk batched several documents together (from other soldiers) and forwarded them to finance for processing. When the documents arrived at the finance office, a receiving clerk reviewed them for correctness. Documents that were not prepared correctly were returned to the unit that sent them. If the document was correct, a copy was placed in the soldier's folder. The other copies were batched together and mailed to the United States Army Finance and Accounting Center (USAFAC) in Indianapolis, IN (USAFAC later became the Defense Finance and Accounting Service (DFAS).

The Joint Uniform Military Pay System was implemented about 1968. This system took advantage of the latest keypunch technology to automate the process of making pay changes to a soldier's pay record. The FDRF was renamed the Personal Finance Record (PFR). Each finance office continued to maintain a PFR for each soldier.

The Military Pay Document Process used JUMPS: The process didn't change much. Soldiers were still required to go to their Milpo and get advice and documents from the personnel clerk. The preparation and routing of the documents using JUMPS were virtually the same as with the FDRF system. The difference in the FDRF and JUMPS was most evident in the finance office. The real difference is that once documents were inside the finance office, they were married with a soldier's PFR. Many

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PFRs and documents were placed on a block ticket and forwarded to a finance clerk who would prepare the keypunch forms by hand for each transaction. The block ticket with the keypunch forms were forwarded to the quality edit section where the forms were key punched in "80-80" cards. After the keypunch listings were verified for correctness, they were transmitted to USAFAC to update a soldier's pay account. Using JUMPS USAFAC automated the calculation of soldiers' pay.

The JUMPS Automated Coding System was implemented about 1983. JACS used even more advance technology to accomplish the mission of making changes to soldiers' pay accounts. JACS hardware consisted of an IBM mainframe at USAFAC, which centralized all soldiers' pay accounts, and remote terminals in each finance office. The PFRs were eliminated and the documents were coded in 80-80-card format using the remote terminals. The coded information was stored on a local mini computer at each finance office until the end of the day, at which time it was copied to tapes and electronically transmitted to USAFAC to change the soldier's pay account.

The Military Pay Document Process used JACS: This new system represented no change in the process. It simply allows the old process under JUMPS to be done faster. However, this process added another layer of controls, by requiring two coders to code the exact same document (The coders were commonly known as "coder one" and "coder two"). A reviewer verified both coders' transactions for correctness. The transactions that were coded correctly were saved for later transmission. This additional layer of controls negated any perceived benefit of automating the JUMPS process. While the objectives of these controls may be laudable, many organizations fail to recognize the cost associated with strict controls. [Hammer and Champy, 1993] This is a classic case of embedding outdated processes in silicon and hardware. Hammer (1990) might suggest that the process be obliterated and use the new technology to radically improve the process not just automate the existing process.

The Defense Joint Military Pay System was implemented about 1994. This is the current system used by DOD. This is a personal computer (PC) based system. There is a centralized database stored on an IBM mainframe located at DFAS-Indianapolis, which contains the master military pay account (MMPA) for each soldier in the Army. Consequently, a finance clerk via PC and a direct connection from the military

installation to DFAS can access any soldier's MMPA. Under DJMS coder two was eliminated. However there is still a reviewer.

The Military Pay Document Process used DJMS: The soldier is required to go to his Personnel and Administration Clerk (PAC) to receive the necessary forms and some limited advice. The PAC is the same organization as Milpo with the same basic function -- the name just changed. PAC clerks are personnel specialists, not finance specialists; therefore they are not always able to give the best advice concerning finance pay change issues. The major change is that the documents are coded on a PC downloaded to a floppy disk and uploaded directly to the database at DFAS-Indianapolis. The changes to the soldiers' MMPA are made much faster once the information is uploaded to DFAS-Indianapolis.

The Coast Guard (CG) has experienced a similar evolution in its Military Pay Document Process (MPDP) from a manual system, called the "Yellow Card", to an automated pay system called "Standard Workstation" (SWS). The CG has implemented two different pay systems to help improve the performance of the pay mission. These systems are the Yellow Card and JUMPS. Under JUMPS the CG has used mainframe and dummy terminal technology as well as PC based technology.

The Yellow Card System was implemented in 1915. This "card" looked something like an accounting ledger and all the transactions for a sailor's account was recorded on it. The card reflected the sailors' base salary as a credit and on the 15th and 30th of the month when the sailor was paid his card would be manually annotated with a debit for the amount of the sailor's pay.

The Military Pay Document Process used the Yellow Card: In the pre-automated days, the member would go to his unit Yeoman and request the necessary forms to make a pay change. The sailor's unit Yeoman forwarded the documents to the local Personnel and Service Unit (PERSU). The PERSU Yeoman manually posted the pay changes to the sailor's yellow card. In the case of an allotment, the form would go to the pay office for posting to the member's yellow pay card. In the case of a marriage, a copy of the marriage certificate would have gone to the personnel office for an update to the member's service record. Then the personnel office would have sent notice to the

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PERSRU to record the basic allowance for quarters (BAQ) entitlement on the yellow pay card.

This process of making changes to a sailor's card is similar to the process used today to make changes to a sailor's master military pay account located in a centralized database. With the early yellow card system, there were about 500 Yeomen throughout the CG that performed the necessary transactions for sailors each month.

Joint Uniform Military Pay System (JUMPS) was implemented in 1983. The manual process of recording sailors' transactions was automated using JUMPS. JUMPS allowed the CG to establish a centralized finance center with 200 people designated to handle pay and personnel transactions for sailors. This system eliminated many of the 500 Yeomen used when the process was manual. JUMPS ran on a Wang mainframe and used remote terminals at the local PERSUs. This system was known as SWS I.

The Military Pay Document Process used JUMPS: As noted by the Chief of Military Pay Support, Human Resource Service and Information Center (HRSIC), Topeka, KS, "The current automated process is not much different than when we used the yellow cardboard pay cards." Under JUMPS a sailor making changes to his pay account consulted with his unit Yeoman who advised him on financial matters. The service member prepared the necessary documents and returned them to the unit Yeoman who verified them for correctness. The unit Yeoman batched documents together and forwarded them, via mail, to the servicing PERSRU where a PERSRU Yeoman retrieved the documents. The PERSU Yeoman verified the documents for correctness and coded the transactions on SWS I. The PERSU Yeoman then handed the documents to a transmittal Yeoman inside the PERSRU. The transmittal Yeoman electronically transmitted the coded information to HRSIC daily. HRSIC downloaded the information file and batched the transactions with transactions from other PERSRUs. Once a week, HRSIC ran a batch job against the master military pay database to update sailors' master military pay record.

Currently JUMPS is being updated and is now PC based with better communication access to HRSIC from the local PERSUs. Although the automated process is a big improvement over the manual process, the fundamental process has not changed.

2. The Service Goals for the Military Pay Document Processing System

The Coast Guard and the Army have established service goals for the MPDP. As a part of the reengineering process we will consider the goals of each service. The MPDP goals for the Army are to provide quality financial services to customers, reduce finance and accounting cost, provide the objective information infrastructure, and increase the competence of financial management workforce. [DFAS, 1998] The MPDP goals for the CG are to move personnel support closer to the units serviced, integrate procedures and system configuration, reduce process complexity, improve current personnel/pay processes, provide flexible access to personnel and pay data, reduce annual operating costs. [Coast Guard Goal]

B. BUSINESS PROCESS REENGINEERING

Reengineering originated in the private sector as a method for helping companies sustain and preferably increase market shares in a competitive and dynamic marketplace. Although the reasons for change may be different for government -- such as increasing workload, shrinking budgets, and personnel reductions -- the need for significant performance improvement is no less imperative.

1. Reengineering Overview

Business Process Reengineering (BPR) is an approach to dramatically improve operating effectiveness through redesigning critical business processes and supporting business systems, as opposed to incremental improvements. Hammer and Champy (1993), well known reengineering experts and creators of a best selling book, define reengineering as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed". Hammer and Champy provide further insight into their definition by identifying four key words: fundamental, radical, dramatic, and processes. These key words are discussed in detail in the succeeding paragraphs.

The first word *fundamental* implies that organizations must clearly understand why they exist. Once that's clear, they must intimately understand why they do what they

do. Hammer and Champy suggest that organizations should answer two questions: Why do we do what we do? And why do we do it the way we do? Government organizations are especially guilty of operating according to ad hoc rules, which have evolved over time but are no longer are appropriate. Military organizations are notorious for writing pages of standard operating procedures, which are rules governing the way an organization operates. However, most of these SOPs are out dated and have little congruency with the current organizational environment or customer needs. By redesigning processes new SOPs will emerge focused on customers and their needs, ignoring what is and concentrating on what should be. [Hammer and Champy, 1993]

The second key word is *radical*. This word is derived from the Latin word "radix" meaning root. Getting at the root of the problem, finding out what makes the process work the way it does and why it has to be done that way. Hammer suggests that outdated processes should be obliterated and redesigned properly from scratch. [Hammer, 1990] Hammer and Champy (1993) characterize reengineering as a "clean sheet" approach to radical change. The clean sheet approach draws direct contrast to the incremental approach of process improvement.

Process improvement is about enhancing or improving existing processes. Consequently one may improve or speed up a process, with automation, that should never have been done in the first place. Hammer suggests that "it's time to stop paving the cow path and use computers to redesign - not just automate existing processes." [Hammer, 1990] Reading the evolution of the MPDP for the Army and the CG, one can see that the current MPDPs in both services are simply old processes, which have been speeded up using automation. Although some improvements have been made in the process speed, dramatic improvements will require radical changes in the process.

The key word *dramatic* enforces the notion that BPR is not about making marginal or incremental improvements, but about achieving quantum leaps in performance. Organizations expect an order of magnitude in performance gains from a reengineering approach. While some may debate it, most experts would agree that reengineering is an all or nothing proposition that delivers major gains in performance. In order to achieve this sort of performance improvement, the Army and the CG finance community must "break away from conventional wisdom and constraints of

organizational boundaries". [Hammer and Champy, 1993] Dr. Sharon L. Caudle (1995), who wrote her dissertation on her experiences with reengineering government agencies, suggests that processes cross functional units and/or organizational boundaries to involve other organizations or individuals. In fact, a business process is basically independent of formal organizational structural arrangements and reporting relationships. A process is how the organization delivers value to the customers, regardless of the hierarchy and vertical structural designs. For most military managers who are anchored to their functional area, this is a very different view. Caudle says the "functional foxholes" of areas such as personnel, finance, budgeting, operations, and evaluation must be transformed into "process streams". Organizations as traditional as the military must replace their vertical view of independent functions with a horizontal view of many interlocking processes. [Caudle, 1995]

Based on Caudle's studies of government organizations and their composite experiences, she has developed a definition for government reengineering.

Government business process reengineering is a radical improvement approach that critically examines, rethinks, and designs mission-delivery processes and sub-processes. In a political environment, it achieves dramatic mission performance gains from multiple customers and stakeholder perspectives. It is a key part of a process management approach that continually evaluates, adjusts, or removes processes or sub-processes for optimal performance."[Caudle, 1995]

There are other reengineering practitioners who have come up with their own definitions for reengineering. In essence, they boil down to a systematic approach, not necessarily done the same way by everyone, that allows managers, subordinate managers, and line workers to fundamentally reexamine, rethink, and redesign old ways of doing business -- achieving dramatic, measurable improvements in critical measures of performance. Reengineering is about fundamental change.

While scholars and non-scholars may define reengineering slightly different, most will agree that customers ultimately define value, and without a customer focus, an organization risks missing what matters most in achieving its mission. They will also agree that reengineering critically examines the underlying assumptions about how an

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organization conducts its work, examining not only the work processes, but the underlying business rules that dictate how work is performed. Although reengineering can be a highly complex and high-risk endeavor, organizations that have reengineered successfully generally followed a set of identifiable practices and a sound methodological approach. While reengineering reaches far beyond business process to achieve the dramatic performance gains, it is not a panacea; it is one element of a comprehensive process management program. [GAO, 1995]

The desired outcome of reengineering is a customer-focused organization that experiences extraordinary gains in productivity. "Reengineering -- with its radical changes in areas such as work flow, rules and regulations, job content, job skills, decision-making, and information systems -- is the only thing that can bring about [dramatic] improvement in either the total process or a process' major sub-processes." [Caudle, 1995]

2. What Will Be Measured?

Business process reengineering is a structured approach that relies on performance measurement to determine which process to reengineer and to determine if proposed changes will have a productive impact. Performance measurements are defined in this thesis as an indicator that can be used to evaluate quality, cost, or cycle time characteristics of an activity or process usually against a target or standard value. It is an established, consistent way to measure the rate of change within an organization. However, performance measurements alone do not provide enough insight to redesign the process to improve performance. Consequently, a means for measuring the components of the process, identifying process pathologies, and identifying possible redesign alternatives is needed. The tool used to accomplish this is called KOPeR. This tool is discussed in detail in Chapter III. The authors will measure the MPDP performance using the performance measurements in Table 1 and the process components using the measures in Table 2.

Table1 Performance Measures

Measurements	Definition
Cycle Time	The measurement of the time an item remains in the process, either in the entire process or in a specific part of it. Cycle time measures how long it takes to get from point A to point B (e.g., beginning to end).
Cost	The price or imputed value of each resource assigned to an activity that is consumed in the process of producing the products and services of that activity.
Quality of Service	The traditional definition states that quality is the degree of excellence possessed by a product, service, or other output of a business activity or business process. We define quality as, how well the process conforms to the customers' requirements.

Table 2 Process Measures [Nissen, 1994]

Measure	Definition
Process Length	Number of nodes in longest path
Process Breadth	Number of distinct paths
Process Depth	Number of process levels
Process Size	Number of nodes in process model
Process Feedback	Number of cycles in process graph
Parallelism	Process Size divided by Length
IT Support	Number of IT-support attributes
IT Communication	Number of IT-communication attributes
IT Automation	Number of IT-automation attributes
Process Handoffs	Number of inter-role edges
Value Chains	Number of unique activity Value Chain attributes

3. How Will The MPDP Be Changed?

To achieve the dramatic improvements that BPR can bring, the authors consider making changes to the MPDP by eliminating non-essential, non-value-adding steps,

implementing and inserting technology where appropriate, improving workflow to emphasize value-adding functions, providing metrics for meaningful analysis and strategic planning, moving pay support closer to the customer, reducing current system complexity that drive cost, combining several jobs into one, reducing unnecessary checks and controls, and allowing work to be performed where it makes the most sense. [Hammer and Champy, 1993]

Service organizations, such as the financial communities of the Army and the CG, must put their professed commitment to customer satisfaction at the center of the redesign effort. In government organizations, the authors note from their own experiences that service workers or finance clerks are unable to satisfy the customer because they must follow strictly defined rules, and lack the authority to make exceptions or the resources to complete a transaction. Therefore, the authors seek to redesign the MPDP making the customer the starting point for change.

4. Overview of Business Process Redesign Methodologies

Our research efforts to find a structured approach to BPR left us somewhat empty handed. Although there are many opinions and keen insight to BPR, there is little detail about what specific steps to take to reengineer the identified processes. However, Sharon Bitzer's (1995) thesis, *Workflow Reengineering: Business Process Reengineering with Workflow Management Technology,* does an excellent job evaluating four different methodologies from four different BPR practitioners. The four published methodologies evaluated by Bitzer are from Mark Klein, Thomas Davenport, H. J. Harrington, and the Department of Defense. The authors encourage the reader to examine each methodology in more detail prior to beginning a reengineering project. The intent of the authors is to review the evaluation made by Bitzer and determine an appropriate methodology to use in redesigning the MPDP.

Bitzer compares each methodology against the characteristics outlined in the Department of Defense (DOD) manual on business process reengineering. According to Bitzer, DOD states that an effective methodology for change must conform to the items in Table 4 (DODINST 8020.1-M, 1993).

Table 3 DOD Characteristics of an effective methodology

Item	Definition
Complete:	It must provide steps that direct a business process improvement procedure from establishment to implementation.
Applicable:	The methodology must be able to be used on any process of the business.
Friendly:	The procedure must be easy for all personnel, including non-technical workers and managers, to learn and understand.
Consistent:	It must be the only method used to conduct reengineering within the organization. This will allow in-house reengineering expertise to be developed.
Supported:	The engineering procedure must include detailed documentation, training courses and project management tools.
Successful:	The methodology should have a record of success and these cases should be available to guide the actions of the reengineering team.
Documenting:	The procedures must produce process documentation as it is used.
Enabling by Tools:	The method must be supported by automated tools that help ease the reengineering workload and enable process documentation and measurement

Bitzer (1995) concluded in her evaluation of the four methodologies that Klein's, Davenport's, and Harrington's methodologies do not exhibit all the characteristics of an effective methodology. Bitzer rejects Klein's methodology because it does not specify any tools, automated or not, and it gives no examples of the methodology's success. Davenport's methodology is rejected because "it is not comprehensive". Bitzer notes that Davenport fails to specify steps for gaining management support. He focuses most of his attention on gaining a greater understanding about what the process should do, while his methodology, in Bitzer's opinion, lacks direction on how to identify changes to a process. Bitzer suggests that Harrington's methodology is the most complete. While furnishing

detailed steps, Harrington provides guidance on how to organize for improvement, what data should be collected prior to analyzing a process, and he provides guidance on how to improve the process. However, Bitzer also rejects Harrington's methodology because it does not specify computerized software tools to be used during the redesign process, nor does it mention any simulation tools used prior to implementation. Of all the methodologies evaluated, Bitzer noted DOD's methodology as being the most comprehensive and the one that most closely exhibits the characteristics of an effective methodology. Bitzer evaluated DOD's methodology as the best. However she noted that the modeling tool specified for use by the methodology is complicated and lacks the integration of process modeling, cost analysis, and simulation.

A methodology not included in Bitzer's thesis is one developed by Nissen. This methodology is a unique blend of several of the methodologies discussed above. As noted, all above methodologies contain some faults. Most importantly, Nissen's synthesis of several expert methodologies creates a methodology, which supports process measurements with "rigor and precision". [Nissen, 1997]

5. Methodology Used To Redesign MPDP

Following these steps, the authors use Nissen's methodology (see Figure 1) to redesign the MPDP. The steps associated with this methodology are as follows:

1. Identify the process
2. Model the process
3. Measure the configuration
4. Diagnosis the pathologies
5. Match the transformations
6. Generate redesign alternatives
7. Test redesign alternatives
8. Select preferred choice

The authors identified a sub-process of the Military Pay System for the United States Army and the United States Coast Guard. The MPDP, defined in Chapter I, was chosen because it presents an excellent opportunity for dramatic improvement. Experts suggest the reengineering should consider processes with the most possibility for

dramatic improvement. Based on one author's first hand knowledge and nine years of experience as a finance officer, he concludes that reengineering the MPDP has potential for dramatic improvement. Using Extend + BPR modeling and simulation software the authors model the baseline (i.e., "as-is") process and measure the process cost, cycle time, and quality (see Table 2). Using KOPeR (pronounce "cope-er") the baseline process configuration is measured (see Table 3 Process Pathologies). These measurements "drive the diagnosis of process pathologies" (see Table 5). [Nissen, 1997] After measuring the process and diagnosing the pathologies we "treat" the pathologies by matching the redesign transformations (see Table 4 Redesign Transformations) available. During this step the authors look at technology, workflow, and information available to improve the process. Based on the diagnosis and treatment recommendations, redesign alternatives are developed. Using Extend + BPR, the critical performance measures of the redesigned alternatives are compared with those of the baseline model to determine if treatment was effective. By testing the redesign alternatives, using modeling and simulation, performance is compared to the baseline benchmark to determine the performance improvement. KOPeR and Extend + BPR tools are discussed in Chapter III. [Nissen 1997]
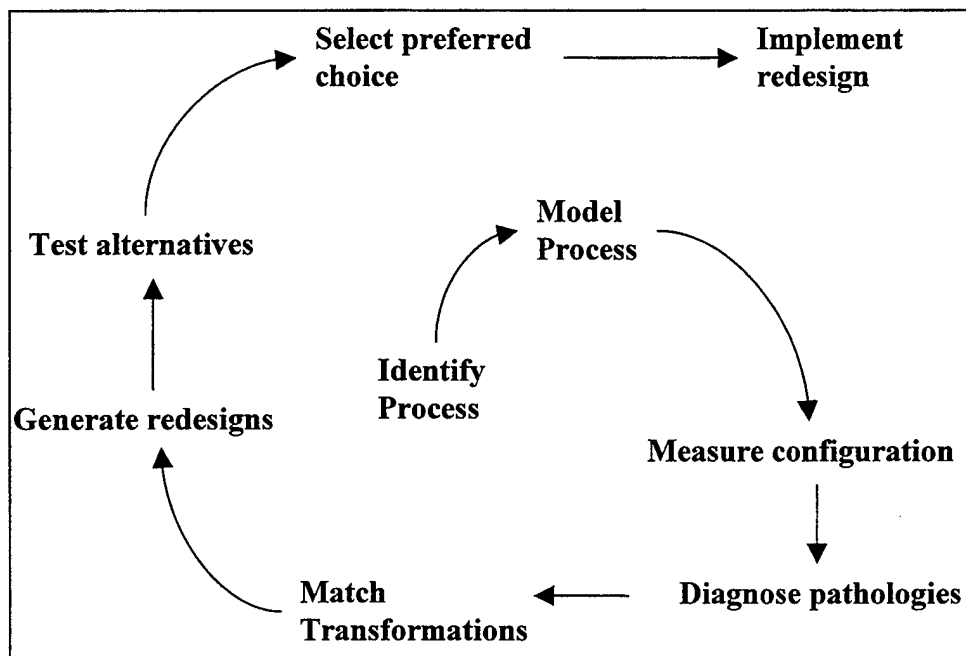
Figure 1 - Redesign Process Methodology (KOPeR approach)

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III. MODEL DEVELOPMENT TOOLS AND "AS-IS" PROCESS

A. MODEL DEVELOPMENT TOOLS

1. EXTEND

EXTEND + BPR modeling and simulation software is used to model the MPDP and assesses the performance of the baseline process as well as the relative performance improvements of the process' redesign alternatives discussed in Chapter IV.

a. *EXTEND Overview*

EXTEND + BPR is an object-oriented environment for modeling, analyzing, reengineering, and documenting processes. It uses an iconic building-block paradigm to facilitate communication and allows the authors to concentrate more on process design than on any particular methodology. The MPDP is composed of real-world elements and processes that interact when specific events occur. Using EXTEND + BPR, the authors are able to simulate the MPDP system using blocks which mimic the real-life processes and timing that represent the actual occurrence of events. The blocks used in EXTEND + BPR directly correspond to the activities (coding documents), queues (in/out boxes), delays (cycle time), and transformations that comprise the process to be redesigned.

Using EXTEND + BPR the authors can easily incorporate high-level reengineering concepts such as batching, cycle timing, activity-based costing, and conditional routing. This software is excellent for the redesign of the MPDP, for it de-mystifies modeling and simulation and allows non-technical personnel, such as managers and the people who do the work, to utilize simulation for analysis and redesign of business processes. The authors use this software to assist in answering the primary question proposed by this research: *How can the Military Pay Document Process be redesigned to improve critical measures of performance such as cost, cycle time, and customer service.* Measurements and predictions about cycle time, cost, quality, and the cost of implementing alternatives serve as a basis for developing high-performance alternatives that can get the Army and the CG financial communities from the "as-is" to the "to-be". However, developing a specific strategy to go from the "as-is" to the "to-be"

design is beyond the scope of this thesis and is recommended for future research. Following the redesign methodology discussed above the authors use the information obtained from KOPeR and EXTEND + BPR simulation to generate and test promising redesign alternatives.

b. Input Variables for EXTEND

EXTEND requires input data and variables to drive the model. Time dependent data such as document arrival time and document review time is one type of data that is necessary. The other type of data is probabilistic data - data such as the probability of a document being rejected by the finance-receiving clerk. These variables allow the authors to measure cycle time. Cost data is also important to compare relative cost of process alternatives. To obtain the input variables the authors consulted with an Army finance unit (Table 4 Input Variables - US Army) and a Coast Guard PERSRU (Table 5 Input Variables - US Coast Guard). The input variables are a result of interviews with senior finance personal who are intimately familiar with the details of the MPDP.

Table 4 Input Variables - U.S. Army

Variables	Distribution/Value (avg.)	Source (averages)
PAC Process		
Document arrival rate - PAC	5 min (per document)	Expert estimate
Document review rate - PAC	6 min (per document)	Expert estimate
Prepare Transmittal Letter	1 min (per document)	Expert estimate
Number of Documents remaining in the PAC's inbox from the prior day	4 per day	Expert estimate
Delay time for unit PAC to courier documents to finance	30 min	Expert estimate

Finance Process		
PAC arrival rate - Finance Office	15.45 min	Expert estimate
Document review rate - Finance Office	5.25 min	Expert estimate
Document processing rate - Finance Office (per coder/per batch)	17.14 min	Expert estimate
Hourly regular military compensation.	$9.03/per hour	1999 Pay Tables (E-4 with 3 years of service)

Table 5 Input Variables - U.S. Coast Guard

Variable	Distribution/Value (avg.)	Source
Unit Yeoman Process		
Document arrival rate - unit Yeoman	30 min (per document)	Calculated from data
Document review rate - unit Yeoman	5 min (per document)	Expert estimate
Number of Documents remaining in the Yeoman's inbox from the prior day	3 per day	Expert estimate
Delay time for unit Yeoman to courier documents to finance	3.5 hours	Expert estimate
PERSRU Process		
TL arrival rate - PERSRU	18 min (per TL)	Expert estimate
Document review rate - PERSRU	10 min (per TL)	Expert estimate
Document processing rate - PERSRU (per coder/per batch)	20 min (per TL)	Expert estimate
Hourly regular military compensation	$10.38/per hour	1999 Military Pay Tables (E-5 with 5 years of service)

The exponential function is widely used to analyze times between independent events such as arrival times. Many phenomena are exponentially distributed, such as the times between arrivals of aircraft to an airport and the time between documents arriving at the finance office. [Pegden, Shannon and Sadowski, 1995] Pegden, Shannon and Sadowski (1995) note that when determining input variables, reliance on the following sources may prove to be the best option: 1) operators, 2) vendor claims, and 3) theoretical considerations. Therefore it is assumed that the document for the MPDP arrival time is exponentially distributed. The document arrival time for the Army PAC is 5 minutes per document. PAC clerks arrive at the finance office with a batch of documents every 15.45 minutes. The document arrival time is also exponentially distributed for the CG with one document arriving at the unit yeoman's office every 30 minutes and a unit yeoman arriving at the PERSRU with a batch of documents every 18 minutes.

2. KOPeR

a. Overview

Knowledge-based systems (KBSs) are used to support process redesign. KOPeR (knowledge-based organizational process redesign - pronounced "cope-er") is a proof of concept system KBS, which provides an automated reengineering method to evaluate redesigned alternatives. "The KOPeR design draws from the artificial intelligence (AI) methods and technologies, which allow it to capture process redesign knowledge from the reengineering literature and practice through twin taxonomies and production rules." [Nissen, 1997]

Nissen defines KOPeR as a graphed based tool (i.e., comprised of nodes, edges, and attributes), which produces a battery of graph-based diagnostic process measures automatically. As diagnostics these measurements are used to detect severe pathologies and faults associated with a process. KOPeR employs a base of formalized reengineering knowledge (i.e., knowledge base) to predict which design transformations are most likely to effect dramatic improvement in process performance. These

transformations are then applied to the baseline (i.e., "as-is") process model to generate one or more re-design alternatives. [Nissen, 1997]

Once the process model has been validated and calibrated against the process baseline, EXTEND + BPR simulation software is used to test the performance of each redesign alternative. Combining the KOPeR model with EXTEND + BPR represents an efficient technique when evaluating alternate process redesigns, and it helps reduce the inherent risks of reengineering by providing a method to evaluate redesign alternatives before committing time and money.

b. Input Variables

Simulating the baseline process using EXTEND + BPR provides a graphical depiction of the process for applying KOPeR. The graphical depiction of the process is used to calculate the measures for the MPDP "as-is" and "to-be" process (i.e., steps, length, breadth, depths, size, feedback, parallelism, handoffs, information technology support (IT-S), information technology communication (IT-C), and information technology automation (IT-A)). Figure 2 shows an example of how graph based measurements can be used to represent the inputs to KOPeR for redesign. [Nissen, 1994]

Breadth

A → doc1 → B → doc1 / doc 2 → C → doc1 / doc2 → D

- Check   - Price   - Terms   doc3   - Review
- Check-agent   - Price-agent   - Terms-agent   - Manager
- DBMS   - DSS   - word_proc   - nil

Depth

Length

Measurements

Length = 4 Breadth = 1 Depth = 1 Handoffs = 3
Size = 4 Feedback = 1 Parallelism = 1.00
IT-support = 3 IT-communication = 0 IT-automation = 0
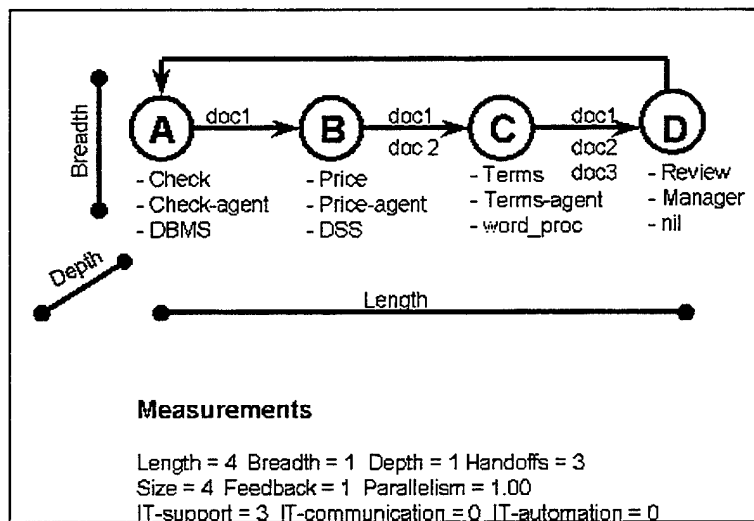
Figure 2 - Process Model

In order to evaluate these measures, a Level 1 and Level 2 baseline representation is developed for each organization. Then the input variables needed for

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KOPeR are calculated as described in Chapter II, Table 2. In the following two sections we begin the first step of Nissen's methodology by describing the "as-is" MPDP for the Army and the CG.

B.   UNITED STATES ARMY MILITARY DOCUMENT PROCESS

This section describes the "as-is" MPDP for a United States Army finance unit providing pay support to soldiers co-located on the same installation. Although the process description is that of a particular finance unit, it reflects the process flow of most finance units.

1.   "AS-IS" Process Description

The U.S. Army MPDP is a linear batch process. Soldiers create documents by requesting pay changes. The documents are given to the soldier's unit personnel and administration clerk (PAC), who couriers the documents to the finance office for processing. At the finance office the documents are reviewed, coded, and transmitted to DFAS. At DFAS the documents are processed against the soldier's master military pay account (MMPA). A level 1 schema of this is represented in Figure 3. Figures 4 and 5 show the decomposition of the PAC processes and the finance office process respectively.
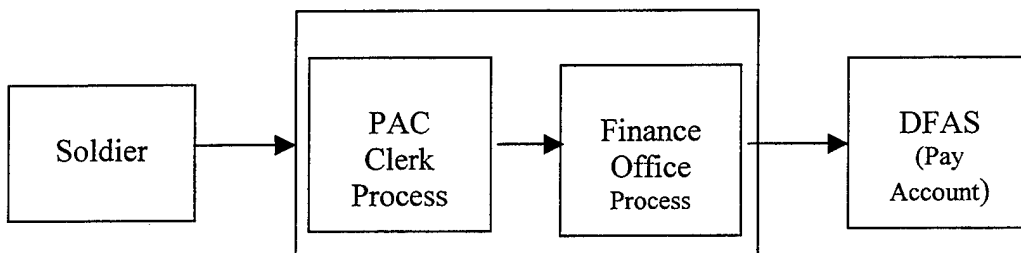
Figure 3: US Army level 1 schema ("AS-IS")

The detailed process is as follows: A soldier decides he wants to initiate a pay change (Typical pay transactions are listed in Table 6). The soldier reports to his personnel and administration clerk (PAC) to retrieve the necessary forms. In some cases the form(s) can be downloaded from the World Wide Web (WWW). The soldier prepares the document(s) and returns it to the PAC. The PAC reviews the document(s)

for completeness and correctness and batches it with other documents received from other soldiers. The PAC covers the batched documents with a transmittal letter (TL) which lists all the documents in the batch and couriers the documents to the finance office.
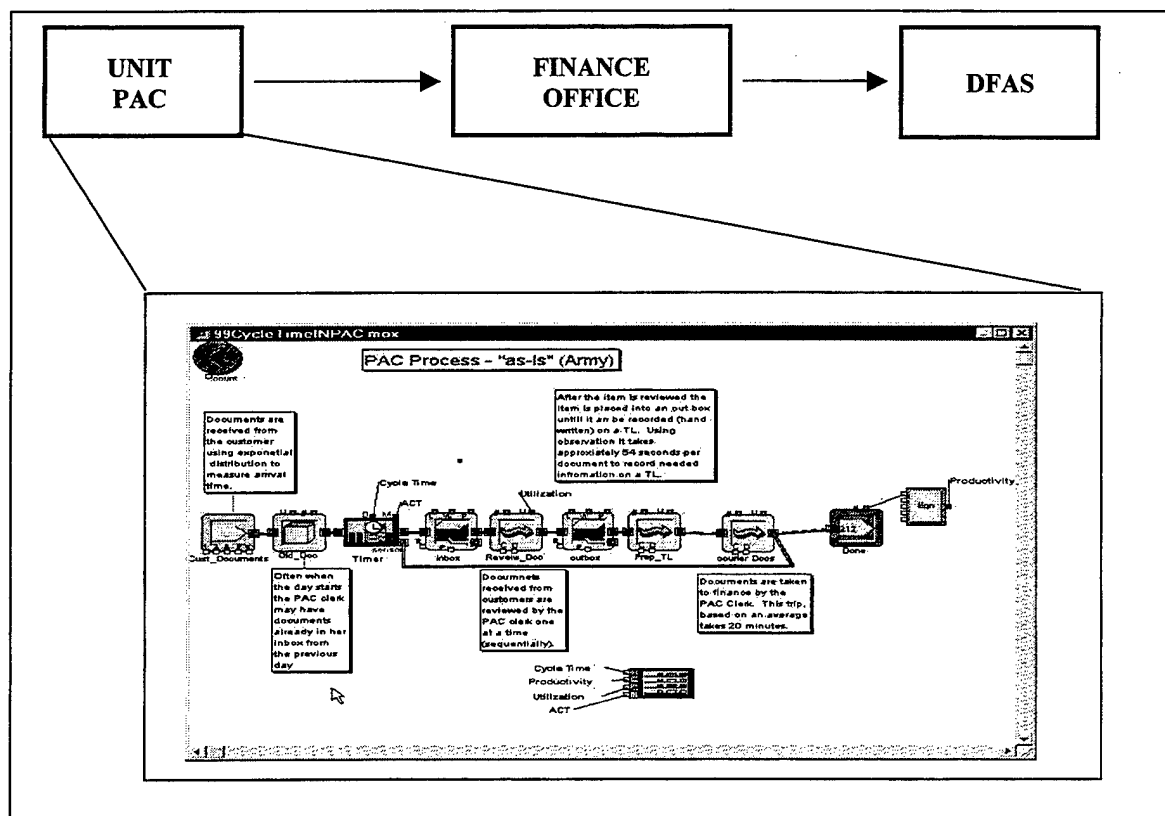
Figure 4 Unit PAC Process (decomposition)

A receiving clerk at finance reviews the documents again for completeness and correctness. Documents that are not prepared correctly are given back to the PAC clerk. The receiving clerk takes the documents to the coding section where they are sorted by type and placed in a document bin. Coders retrieve documents from the document bin and process them. At the end of the day the coder saves the coded transactions onto a floppy diskette, makes a hardcopy printout of the coded transactions and gives the hardcopy and the documents to the auditor.
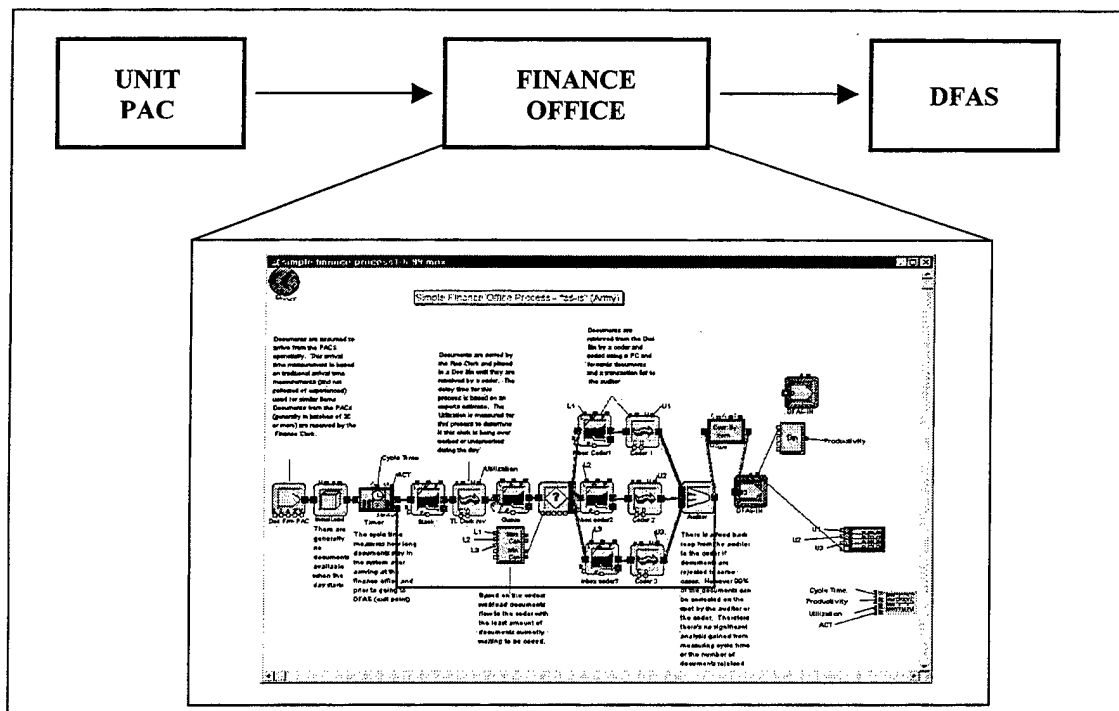
Figure 5 Finance Office Process (decomposition)

The auditor reviews the coded transaction given to him by the coder and transmits them to DFAS-IN to process against the soldier's MMPA. If the transactions are without error the changes are reflected on the soldiers MMPA. If any uploaded transaction is in error, the transaction is rejected and is re-worked by the coder. These errors are generally corrected immediately with minimal addition to the processing time.

Table 6 Typical Pay Transactions

Transaction Form		Transaction Name	Transaction Effect
US Army	**US Coast Guard**		
DA Form 3685	N/A	Direct Deposit	Deposits Money To specified Financial Institution or Bank Accounts

DD Form 2558	N/A	Allotment (stop/start/change)	Deducts money out of sailors pay and sends it where directed (Insurance Company, U. S. Savings Bond purchase, Mortgage Payment, or Individual)
DD Form 2058-1	DD Form 2058-1	Tax exemption status.	Allows sailor to change his tax exemption status.
DD Form 2559	DD Form 2559	Savings Bond Allotment	Deducts Money from soldiers pay to purchase savings bonds for soldier.

2. Simulation Results of the "AS-IS " Process - U.S. Army

Table 7 presents a summary of the data obtained from the simulation model. Using the level 1 diagram as the starting point, a separate model was created for the tasks performed by the unit PAC and the finance office. The tasks performed at DFAS-IN are not modeled because they represent the exit point of the MPDP.

Table 7 Simulation Output Results - U.S. Army

Measurement	"As-Is" Model Average Values
PAC Transaction Processing	
Average Cycle Time per document	1.36 hours
Cost of PAC labor	$115 per day / $3450 per month
Productivity per PAC clerk per day	79 per day
Utilization per PAC clerk per day	53% average
Finance Transaction Processing	
Average Cycle Time per document	16.36 minutes
Cost of finance labor	$281 per day / $8430 per month
Productivity of the finance process	308 documents per coder
Utilization	97%

The PAC's tasks represent the first process of the MPDP as shown in Figure 4 above. By setting EXTEND's modeling parameters based on the data in Table 4, we determine the cycle time, productivity, utilization measurements, and cost. As shown by the graph in Figure 6, cycle time and average cycle time is plotted on the left axis, while productivity and utilization is plotted on the right axis.
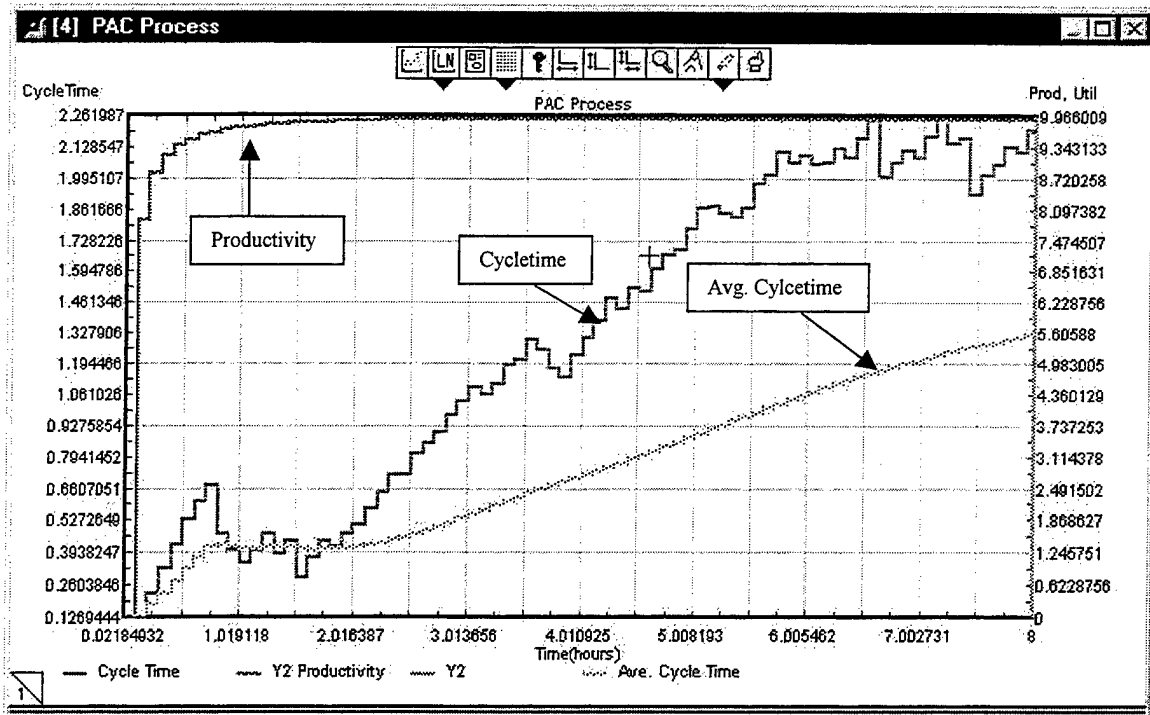
Figure 6 Army PAC "AS-IS" Results

Cycle time is the measurement of the time an item remains in a process, either in the entire process or in a specific part of it. In this process cycle time represents the actual time it takes for the PAC clerk to review documents received from customers and prepare a TL. As shown in the graph above cycle time continually increases. While the average cycle time is 1.36 hours, documents arriving at the end of the day have a cumulative cycle time of approximately 2.5 hours. The increase in cycle time for documents arriving at the end of the day is attributed to the standard operating procedures enforced by the finance office. PAC clerks have approximately a three hour window of time in the morning (0800 until 1100) to bring documents to finance for processing that day. Therefore documents received during the first few hours of the day are processed immediately. Documents received after 1100 remain in the PAC's inbox until the next morning. However it is important to note that PAC clerks do more than process finance documents. Processing finance documents is only one aspect of their job.

Productivity is a ratio of the outputs to the inputs that produce them. Productivity is often based on how many items can be output in a particular segment of time. For example if a PAC clerk processes 11 documents in one day of labor (8 hours), then

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productivity is 11 per day. The simulation results indicate that a PAC clerk can process approximately 79 documents per day. However, documents dropped off at the end of a day are not reviewed nor added to a TL until the next day. This standard operating procedure increases cycle time and reduces productivity.

Utilization is the ratio of the time busy processing compared to the entire amount of time available for processing. Utilization is calculated by multiplying the total time to process a document by the number of documents then dividing that number by the time it takes to complete the entire process. For example, if it takes 44 minutes to process 11 documents the PACs utilization ratio is 100% based on an eight hour day ((44*11)/480). The simulation suggests that the PAC process is completely busy, during the first 3 hours of the day, when performing the task of reviewing documents, preparing TLs, and carrying them to finance. [Diamond, 1998]

The cost for a PAC clerk to process documents received by a customer, courier documents, and wait while the finance receiving clerk reviews the documents is calculated using the activity base costing (ABC) functions in EXTEND + BPR software. ABC assigns a cost to the service provided based on its use by the process. The analysis of cost is used to evaluate the labor cost drivers and helps identify possible savings in the redesigned alternatives. Only the direct cost of a clerk's salary is used to determine the cost measurement. The cost per clerk is based on the 1999 regular military pay compensation for an E-4 (pay rate) with three years of service. The regular military pay compensation includes basic pay, basic allowance for subsistence, basic allowance for housing, as well as the tax advantage from untaxed allowances. The hourly rate in Table 4 is used as an input parameter to calculate the cost. PAC tasks are typically, but not in all cases, performed by a soldier of this pay rate. The model suggests the cost for the PAC process is $115 per day or $3446 per month (based on a 30-day month). This amount can be multiplied by the total number of PAC clerks (33 x $3446 = $113,718 per month) who perform a similar process. One can see that this cost alone can be quite substantial over the long term.

Next we examine the "as-is" measurements for the task performed in the finance office. A PAC clerk arrives on an average of every 15.45 minutes with a batch of documents. It takes the finance receiving clerk about 5.25 minutes to review a batch of

documents and it takes a coder an average of 17.14 minutes to process a batch of 11 documents. Cycle time, cost, productivity, and utility are determined in the same manner described above for the PAC process. The cycle time in the finance process measures the time it takes for the finance receiving clerk to review the documents plus the time it takes for the coders to code the documents during an eight hour day. Although reworks effect cycle time we didn't find it significant enough to merit further consideration. The simulation results indicate that the average cycle time is approximately three hours per batch (or seven minutes per document). This means a single document takes seven minutes to be reviewed by the receiving clerk, processed by a coder, and uploaded to DFAS. However, because the processing time is slightly longer than the arrival interval, the cycle time increases for documents that arrive at the end of the day. Therefore, the cumulative cycle time for a batch in the finance process is approximately five hours (or 11.5 minutes per document). The utility measurement shows that each coder is busy, processing documents approximately 97% of the time during the workday. The cost associated with performing this task is $281 per day or $8430 per month.

3. KOPeR Diagnosis of the "AS-IS" Process - U.S. Army

Simulating the baseline process using EXTEND + BPR provides a graphical depiction of the process for applying KOPeR. The graphical depiction of the process is used to determine the process measures shown in Table 8. KOPeR provides intangible measurements, which are often ignored when using simulation models alone. The measures obtained from KOPeR provide baseline values essential for comparing and evaluating redesign alternatives. The comparison allows one to objectively analyze real improvements of the redesign alternative vice redesign alternatives that merely represent minor changes of the baseline process, with no significant improvement of the process. Davenport concludes that there are two primary reasons to measure the process before redesigning it: 1) problems must be understood so that they are not repeated and 2) accurate measurement can serve as a baseline for future improvements. [Davenport and Short, 1990]

Table 8 Process Measures U.S. Army

Measures	Definition	Calculated Measures
Process Length	Number of nodes in longest path	12
Process Breadth	Number of distinct paths	1
Process Depth	Number of process levels	1
Process Size	Number of nodes in process model	14
Process Feedback	Number of cycles in graph	5
Parallelism	Process Size divided by Length	1.167
IT Support	Number of IT-support attributes	7
IT Communication	Number of IT-communication attributes	1
IT Automation	Number of IT-automation attributes	2
Process Handoffs	Process Handoffs	5

Table 9 highlights the process measures and pathologies identified by KOPeR. KOPeR measures suggest that the MPDP baseline process exhibits five pathologies that can have an effect on the process cycle time and cost. In this section we examine the pathologies and their consequence on process performance.

Table 9 KOPeR Analysis for U.S. Army ("AS-IS")

Measures	Value	Pathology
Parallelism	1.167	Sequential Process
Handoffs Fraction	0.357	Process Friction
Feedback Fraction	0.357	Checking & Complexity
IT Support (IT-S) Fraction	0.5	Satisfactory
IT Communication Fraction (IT-C)	0.071	Inadequate IT communications
IT Automation (IT-A) Fraction	0.143	IT requires substantial investment in terms of support, training, and communication

KOPeR's first measurement is parallelism. The value of 1.167 indicates the MPDP is nearly a completely sequential process (1.00 represents a theoretical minimum associated with a perfectly linear process). Sequential processes are widely noted by reengineering practitioners as problematic in terms of cycle time. This sequential process is based on the century-old notion of specialized personnel clerks who perform the administrative function (preparing the paper work) and finance clerks who process the pay transactions (to effect pay). Sequential processes cause problems, because all the data must be available at each step even if it's not needed until a later step. In addition, Hammer and Champy (1993) suggest that sequential processes increase confusion - if a problem with a customer's requirements arise late in the process, the customer (or his documentation) must be referred back to step one, requiring needless delay and rework.

Next the handoff fraction measure of 0.357 indicates that the process is highly departmentalized, resulting in a high level of process friction. Hammer and Champy (1993) suggest that handoffs are responsible for numerous errors and misunderstandings. Moreover the feedback fraction measurement of 0.357 suggest excessive recheck and validation steps. Government bureaucratic organizations are notorious for departmentalizing work into "specialized foxholes". Nissen (1998) notes that fragmented, specialized organizational approaches can lead to increased cycle time and increased cost associated with validation and rechecks. Reducing the handoff fraction can positively impact cycle time and cost.

Finally KOPeR's measurement values for IT-S, IT-C, and IT-A reveal that, although IT for support is adequate, IT for communication and automation are not. With detailed knowledge of the process, one can understand this diagnosis clearly. This means that although adequate IT support is available, it is not paying dividends in terms of improvements in process performance. This suggests that the process was never engineered, and clearly illustrates Hammer's point that IT alone will not improve process performance. The use of information technology enablers such as form tools, word processors, spreadsheet applications and others must be integrated into a comprehensive process redesign plan. Conventional wisdom in the reengineering profession suggests that IT capabilities should not be considered until after the process is designed. However, Davenport and Short (1990) suggest that an awareness of IT capabilities should influence

the process design. "The role of IT in a process should be considered in the early stages of its design." [Davenport and Short, 1990]

The inadequacies in IT-C are attributed to the lack of electronic communication between the PAC and the finance office. Furthermore, lacking IT-A to fully automate simple manual routine tasks presents a significant shortcoming. Even complex tasks requiring (finance) experts can be automated using expert systems and decision support systems with technology commercially available today. Although new technology may require a substantial investment of money and training time, the long-term benefits of reduced cycle time and reduced cost may outweigh the initial investment.

C.   UNITED STATES COAST GUARD MILITARY DOCUMENT PROCESS

This section describes the "as-is" MPDP for a United States Coast Guard Personnel Servicing Records Unit (PERSRU), which provides pay support to sailors located within its Area of Responsibility (AOR). Although the process description is that of a particular PERSRU, it is typical to most PERSRUs that perform a similar mission.

1. "AS-IS" Process Description

The CG's MPDP is very similar to the Army's linear batch process. Documents are created by sailors, given to the unit yeoman who couriers the documents to the PERSRU office for processing. The PERSRU electronically transmits the processed documents to the Human Resource Servicing Center (HRSIC), followed by mailing the hardcopy of each document transmitted. A level 1 schema of this process is represented in Figure 7. Figures 8 and 9 show the decomposition of the Unit Yeoman process and the PERSRU process respectively.
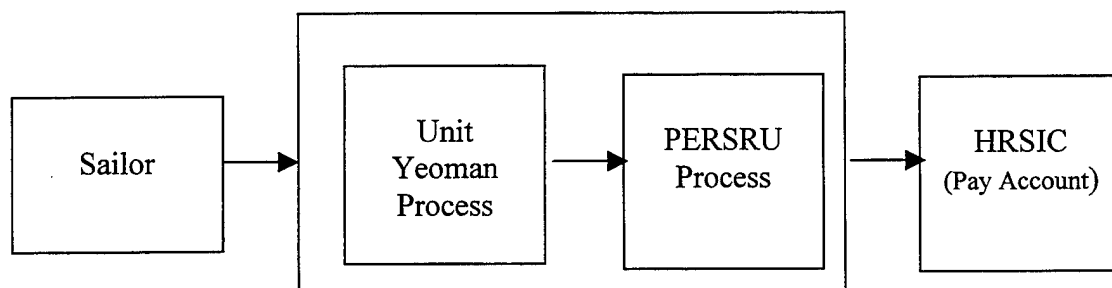

Figure 7: US Coast Guard level 1 schema of baseline process

The detailed process is as follows: A sailor decides he wants to initiate a pay change (Typical CG pay transactions are listed in Table 6). The sailor reports to his yeoman (Coast Guard's equivalent to a personnel and administrative clerk in the Army) to retrieve the necessary forms. In some cases the form(s) can be downloaded from the unit database, or the World Wide Web (WWW). The sailor prepares the document and returns it to the yeoman. The yeoman reviews the document for completeness and correctness and batches it with documents received from other sailors. The yeoman couriers the batch of documents to the PERSRU. It should be noted that documents prepared by sailors who are at sea have a significantly longer courier time. These documents are transported by air and typically take 24 hours to reach the PERSRU.

A PERSRU yeoman (similar to the Army's receiving clerk) reviews the documents submitted by the unit yeoman for completeness and correctness.
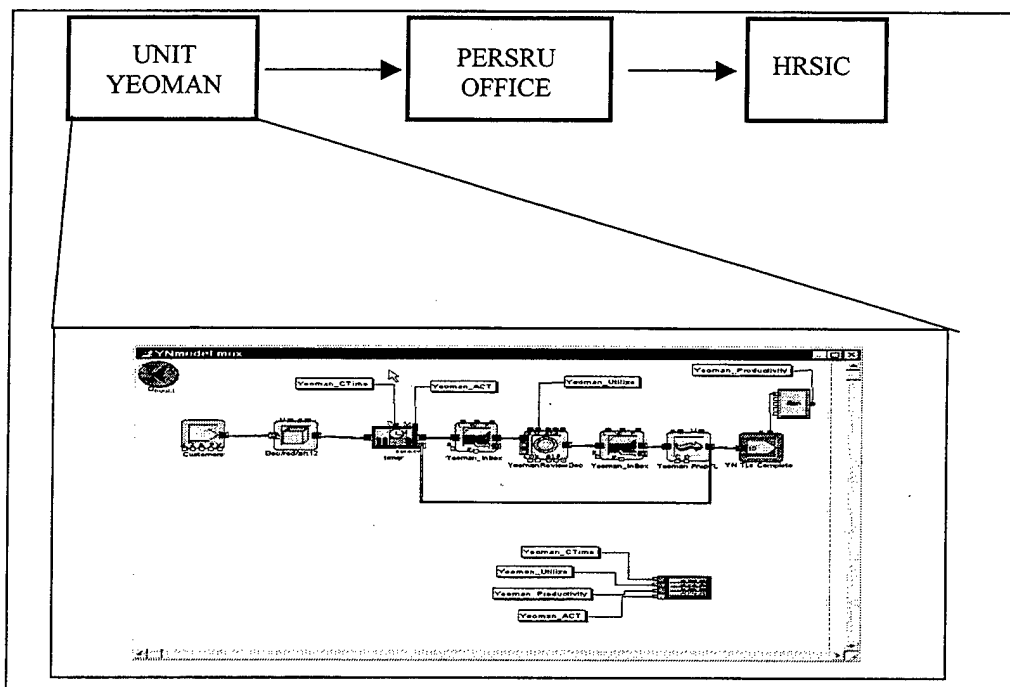

Figure 8 Unit Yeoman Process (decomposition)

Documents that are not prepared correctly are given back to the unit yeoman. The PERSRU yeoman takes the documents, sorts them by type, and codes (keypunches) them into the computer.

Unlike the Army, the Coast Guard does not have yeomen designated only to coding documents. The PERSRU yeoman who receives the document also codes the document. At the end of the day, the coder saves the coded transactions onto a floppy diskette, makes a hardcopy of the coded transactions and gives the hardcopy, the floppy diskette, and the document to the reviewer (similar to the Army's auditor). The reviewer ensures that the transactions are coded correctly. The reviewer, who is also the uploader, transmits the coded transactions to HRSIC to process against the sailor's MMPA. The decomposition of the PERSRU office process is shown in Figure 9. This process is slightly different from the Army, where the auditor and uploader are different people. If the transactions are without error, the changes are processed against the sailor's MMPA at HRSIC. If the uploaded transactions have any errors, they are rejected, reworked and resubmitted.
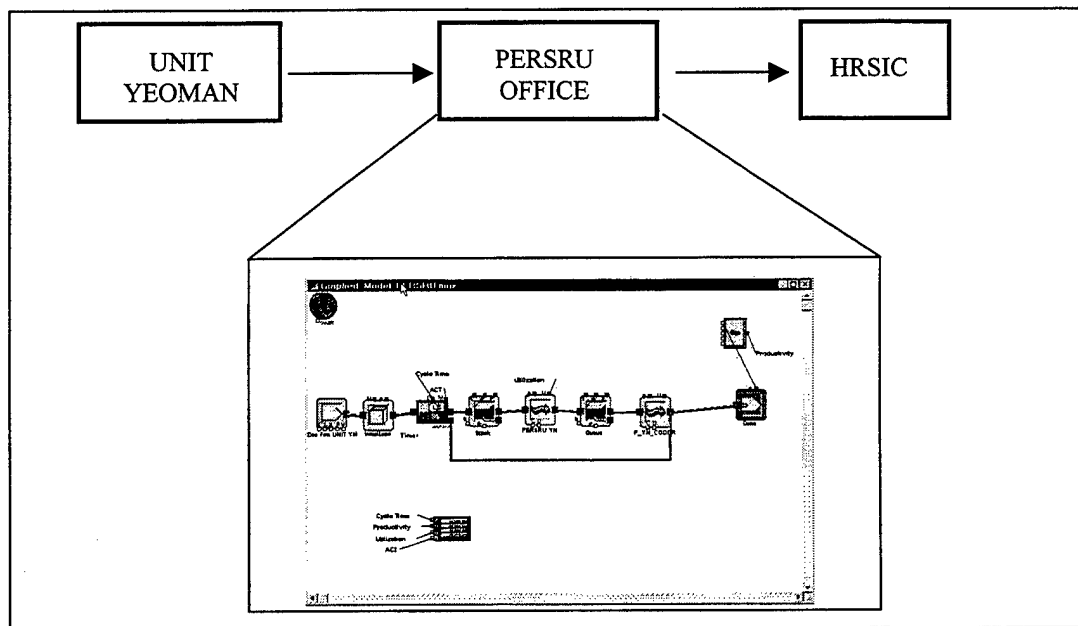

Figure 9 PERSRU Office Process (decomposition)

2. Simulation Results of the "AS-IS" Process - U.S. Coast Guard

The authors simulate the "as-is" process of the CG's MPDP system using EXTEND + BPR. Once the model is created, a simulation run produces the outputs for the CG's yeoman transaction process and PERSRU's transaction process shown in Table 10.

Table 10 Simulation Output Results - U.S. Coast Guard

Measurement	"As-Is" Model Average Values
Unit Yeoman Transaction Time	
Average Cycle Time per document	2.19 hours
Cost per unit Yeoman	$50 per day/ $1500 per month
Productivity of Yeoman per day	7 documents
Utilization	60%
PERSRU Transaction Processing	
Average cycle Time per document	17.25 min
Cost of PERSRU Yeoman	$164 per day/ $4920 per month
Productivity of PERSRU Yeoman Per day	115 documents
Utilization	98%

The unit yeoman transaction process represents the beginning of the MPDP and is the starting point as depicted in above in Figure 7. In order to get measurements of important factors like cycle time, productivity, and utilization cost reflecting the day to day transactions and processes, we use the input variables in Table 5. Cycle time, productivity, utilization, and cost are defined in Chapter III, Section B, Subsection 2.

One of the most important factors to measure and improve in BPR is cycle time. For the unit yeoman, cycle time represents the time it takes a unit yeoman to receive a pay document from a sailor, review the document for correctness, prepare a transmittal letter, and transport the document to the PERSRU. Figure 10 shows that average cycle time is 1.89 hours and accumulative cycle time is 2.82 hours. Documents placed in the unit yeoman's in-box near the end of the day are not processed until the next morning.
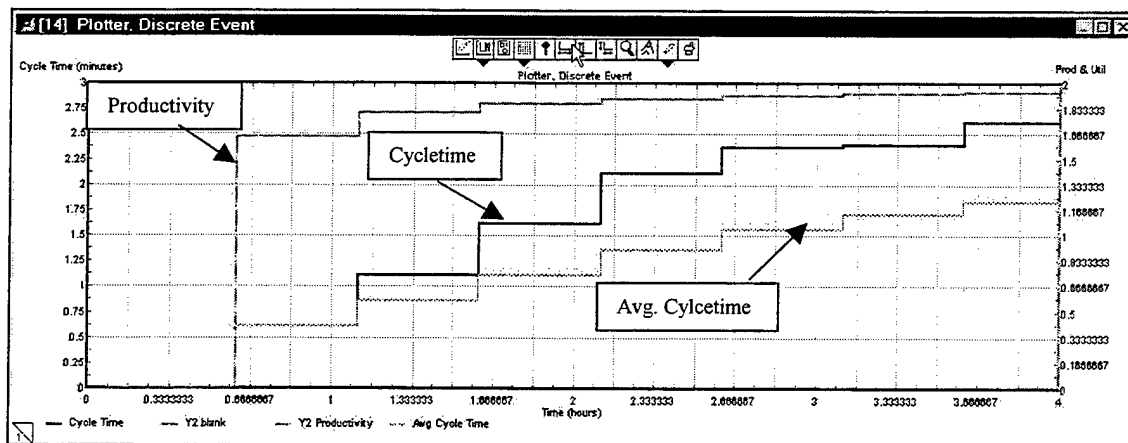

Figure 10 U.S. Coast Guards Unit Yeoman "AS-IS" Results

Contributing to the high cycle time is the standard operating procedures followed by the yeomen. These procedures require unit yeoman to submit documents to the PERSRU between 0800 and 1200 to process for the current day. With only a four hour window to process documents the unit yeoman normally concentrates on finance tasks at the beginning of the day. If documents are not submitted in the allotted window they are held by the unit yeoman and submitted the next business day. It is important to realize that the MPDP process examines only one of many tasks unit yeomen and PERSRU yeomen are responsible for.

Productivity for an eight-hour workday is five pay documents per day. In this case the unit yeoman receives five pay-related documents a day. The yeoman's utilization measurement, based on an eight hour workday says that 40% of the unit yeoman's time is spent doing other jobs, while 60% of his time is spent processing pay documents.

The cost for a unit yeoman to review five pay documents, write a transmittal letter, transport the TL to the PERSRU, and wait for the PERSRU yeoman to review the TL. ABC is used to assign a cost to the service that the yeoman provides. The unit yeoman who completes these tasks normally holds a pay rate of E-5 with five years of service. The 1999 military pay table was used to calculate the hourly basic pay rate of E-5 with five years of service. The model shows a cost of $50.00 per day or $1500 a month for the unit yeoman process. The cost can be further aggregated for the number of unit yeoman typically serviced by a PERSRU.

The next process transaction we examine from the level 1 schema in Figure 7 is the PERSRU process. Documents arrive every 18 minutes at the PERSRU. The PERSRU yeoman takes 10 minutes to review a TL and clear up any obvious mistakes. On average a TL contains a batch of five documents. It takes about 20 minutes for a PERSRU yeoman to code a batch of documents and for the auditor to review coded documents and upload them. Cost, productivity, and utilization are determined using the same technique for the unit yeoman. Average cycle time is approximately 3.5 hours (or about 43 minutes per batch). The simulation suggests that the PERSRU processes 23 batches of pay related documents per day. The utilization measurement shows the PERSRU is fully utilized. The model indicates that 98% of the time is spent processing

finance documents and 2% doing other jobs. The model suggest that the cost for the PERSRU process is approximately $164 or $4920 per month.

3. KOPeR Diagnosis of the "AS-IS" Process - U.S. Coast Guard

Simulating the baseline process using EXTEND provides a graphical depiction of the process for applying KOPeR. The graphical depiction of the process is used to determine the calculated measures shown in Table 11.

Table 11 Process Measures U.S. Coast Guard ("AS-IS")

Measure	Definition	Calculated Measures
Process Length	Number of nodes in longest path	14
Process Breadth	Number of distinct paths	1
Process Depth	Number of process levels	1
Process Size	Number of nodes in process model	14
Process Feedback	Number of cycles in graph	5
Parallelism	Process Size divided by Length	1.00
IT Support	Number of IT-support attributes	7
IT Communication	Number of IT-communication attributes	1
IT Automation	Number of IT-automation attributes	2
Process Handoffs	Number of inter-role edges	5

The results for the CG's MPDP baseline obtained from KOPeR are presented in Table 12. These measurements are used to compare and evaluate redesign alternatives.

Table 12 KOPeR Analysis for US Coast Guard ("AS-IS")

Measures	Value	Pathology
Parallelism	1.00	Sequential Process
Handoffs Fraction	.357	Process Friction
Feedback Fraction	.357	Checking & Complexity
IT Support Fraction (IT-S)	.5	IT support looks OK
IT Communication Fraction (IT-C)	.071	Inadequate IT communications
IT Automation Fraction (IT-A)	.143	IT requires substantial support

The KOPeR diagnosis indicates that the CG's MPDP suffers from sequential process flow, process friction, checking and complexity, inadequate IT communications, and an absence of IT automation. These five measures and pathologies suggest serious performance implications.

First, KOPeR evaluates the baseline process as being a sequential process. The MPDP sequential process is based on the CG's history of specialization training, which focuses workers on one particular part of the process. This has cycle time implications.

Second, we find that there is process friction, which is usually proportional to the number of associated handoffs and feedback loops. We also see that the feedback fraction is high, which tells us that information is being transferred unnecessarily, and that information has to be re-validated while passing through a process. Feedback loops normally increase the number of handoffs because the node initiating the feedback must be revisited. Thus, one key to reducing the number of handoffs is to reduce the number of feedback loops.

Information technology support (IT-S) is a measurement of the number of process tasks that are supported by information technology. It has been stated that simply applying information technology to a process without reengineering it is just a quick fix. KOPeR diagnoses the CG's MPDP as having adequate IT-S, but these tools are severely underused. More robust redesign transformation levers and enablers (i.e., word processors, spreadsheets, e-mail etc.) can have a direct effect on process performance.

Information technology communication (IT-C) is the number of process communications supported by information technology. KOPeR diagnosed this as inadequate for the CG's MPDP. There is limited use of IT-C between the unit yeoman, PERSRU yeoman, and HRSIC. Encouraging more correspondence via email support and the electronic routing of documents should have a positive effect on communication.

Information technology automation (IT-A) is defined as the number of process tasks automated by information technology. KOPeR diagnoses the CG's MPDP as needing to automate process activities. Automation saves time and money by replacing human labor, but in order for the CG to implement this recommendation a substantial infrastructure is first required, particularly in terms of process support and communication. The CG should also look towards workflow systems for support and communication, as well as intelligent agents.

IV. REDESIGN NEW PROCESS

By the end of the "as-is" analysis in Chapter II, the authors have a thorough understanding of the MPDP for the Army and the CG. The "as-is" analysis provides a benchmark of the existing process from which comparison of the redesign alternatives are made. Although every process instance is unique in some respect, military processes in particular share great similarities across various units, commands, services, and even allied nations. Such similarities facilitate the wide spread practice of rotating officers to new units and assignments every few years. This serves to leverage the power of process redesign in the military where service processes are highly similar. What effects redesign for one process instance has excellent potential to also improve process performance across a myriad of other units, commands, and services. This is certainly the case with the U.S. Army and Coast Guard. For this reason, the redesign analysis that follows concentrates on a single, common MPDP, the results of which generalize well across like processes in the Army and Coast Guard. [DTIC, 1998] Thus, because of the similarity in the Army's and CG's MPDP and to minimize repetition and redundancy, we develop redesign alternatives which can easily be applied to either organization, while highlighting significant differences in the application of redesign alternatives to the different services.

Continuing with the methodology in Chapter II, the authors identify transformation enablers and develop redesign alternatives. Our goal is to develop redesign alternatives capable of yielding order of magnitude improvements in process performance.

A. IDENTIFY TRANSFORMATIONS ENABLERS

We begin by identifying and defining transformation enablers. Table 13 presents the class-level taxonomy of redesign transformations, on which we elaborate in this section. [Nissen, 1998] The first five transformations are explicitly addressed through redesign analysis. The latter two - inter-organizational alliance and management and culture - are not considered in present redesign analysis. We feel that by eliminating the middlemen there is little need for traditional inter-organizational coordination. The need

to reduce cost also poses a need to reduce coordination (cost). The infusion of technology in the three alternatives seeks to solve both problems. While we feel that finance management and cultural change is necessary to the initial success of each alternative, it is not essential to the long term success. The alternatives we present eliminate the leadership role and replace it with technology. Initially management will play a key role in obsolescing their job as the MPDP transitions from manual to virtual. New decisions will focus on technological matters and require fewer managers in the loop, as oppose to traditional people matters.

Table 13 Taxonomy of Redesign Transformations

Transformation Class	Sample Instance (Object)
Workflow reconfiguration	Process de-linearization
Information technology	Shared database system
Organizational design	Case manager
Information availability	Informate agent
Human resource	Team-based compensation
*Inter-organizational alliance	Supplier-manager inventory
*Management & culture	Employee stock ownership

Transformation classes considered but not used during the redesign step

Workflow reconfiguration examines how the steps in a process are performed, but not who performs the activities. "Process de-linearization - rearranging serial process activities to be performed more in parallel - represents one example of a transformation enabler from this class." [Nissen, 1998] An important point to make about workflow is that work should be performed where it makes the most sense. In the redesign alternatives for the MPDP we suggest that it makes sense to process the work associated with a pay transaction at the level of the customer. De-linearization is not an option for the MPDP however, because the tasks in the process are sequentially dependent; therefore they can not be performed in parallel.

Information technology (IT) is used to alleviate mundane manual tasks, increase workflow efficiencies and communication across functional areas while improving process performance. Paper-based forms of communication are examined in the MPDP to reduce the number of people-to-people or paper-to-people transactions necessary to provide pay service. Some examples of information technology are shared database systems, workflow tools, networks (Internet and Intranets), and e-mail. IT has great

potential to alter business processes and create new value-added services. [Grenier and Metes, 1995] However, incorrect application of IT may only result in process improvements rather than breakthroughs. Take, for example, the automation of document routing in the travel approval and reimbursement process. Instead of a paper being physically sent from approval station to approval station, electronic forms are routed through the network. This application of IT simply automates existing processes instead of seeking to reengineer the process and take full advantage of the technology. In this case, why route the document at all. Why not electronically post the document to an approval room (similar to a chat room), for that particular document, where authorized approvers can check and handle the approval process. In redesigning the MPDP, workflow tools are coupled with Internet technology to develop alternatives and realize breakthrough performance improvements.

Organizational design looks at changing the organization's structure (e.g., from hierarchical to flat). Case teams are used as enablers to integrate tasks between functional departments. Case teams can help reduce cycle time and cost by eliminating unnecessary handoffs. They also enhance job enrichment by increasing team member responsibility and allowing the team to take full responsibility of process tasks from start to finish. Case teams also allow for the sharing of knowledge and information comprising the team with at least one very experienced member. Non-value added activities that create delay, excess, or redundancy in a process should be eliminated. Activity titles with the following words usually reveal non-value-added activities: move, wait, check, review, verify, store, inspect, rework, record, and approve. Any activity that the customer does not value should be significantly reduced or eliminated. [Grenier and Metes, 1995]

As an instance of the organizational design class we add an enabler called disintermediation. In the redesign alternatives we apply disintermediation as an enabler. Ted Lewis writes in his book, *The Friction Free Economy*, that value can be added to a service by flattening the value chain. "A value chain is flattened by elimination of links. In the terminology of the old industrial economy, these links are called *middlemen.*" [Lewis, p. 132-133] Lewis says that the elimination of links may be as subtle as accessing your bank account from your PC at home, thereby reducing the need for bank tellers and possibly banks. The concept of disintermediation says that by replacing the

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middlemen with technology one can add value to the service while reducing cost and cycle time. In the MPDP the middlemen are considered the PAC functions and the finance office functions.

Information availability examines the type, amount and accuracy of information available for use by the people who need it. There is a vast amount of information contained in finance regulations. This information governs the use, preparation, and routing of finance documents. An enabler that would allow one to take advantage of this information is a decision support system (DSS). A DSS is capable of distilling vast amounts of data into information for customers who require help and answers to common finance questions. Technology can impact this transformation class by providing perfect information to the customer. Lewis (1997) suggests that middlemen exist because of imperfect information. Providing information directly to the customer early in the process, supported by an automated DSS, one could possibly prevent unnecessary rework and feedback. Customers can have immediate access to needed information, without sifting through large regulations previously constrained to the domain of PAC clerks, unit yeomen, finance clerks, and PERSRU yeomen.

Human Resource examines how the new skills are needed to prepare for the new jobs created as a function of the redesign project. The MPDP redesign project requires a close examination of the core competencies needed by finance officers and enlisted personnel. We suggest that finance core competencies must change to support the technical environment needed to reduce cycle time and cost. Tracking well-defined performance measures will allow managers the ability to quantify results and compensation.

B.   GENERATE AND ANALYZE REDESIGN ALTERNATIVES

Now that transformation enablers are identified, we apply them to each redesign alternative. The three redesign alternatives consider a near-term (Alternative One), mid-term (Alternative Two), and far-term (Alternative Three) solution. The redesign alternatives are analyzed using KOPeR, then simulated using EXTEND + BPR, and relative performance comparisons are made against the baseline model.

The near-term solution focuses on a redesign alternative, which can yield dramatic increases in process performance while requiring minimal organizational disruption. This model includes proven technological capabilities currently available from commercial sources and easily implemented. Although the near-term solution can be implemented with minimal effort, it is still radically different than the baseline model. The mid-term solution incorporates the near-term enhancements while increasing the use of technology that include Intranet technologies and advanced workflow tools. This alternative may require a paradigm shift in the way the services view the role of the finance and the PERSRU office. Finally, the far-term solution incorporates alternative one and two while taking full advantage of Internet, workflow, and distributed database technology. Our redesign solutions are based on the notion that by eliminating the middlemen and "squeezing out inefficiencies", in Figure 11, as a part of a comprehensive redesign approach we can reduce cycle time, cost, and increase customer service. [Lewis, p. 133]
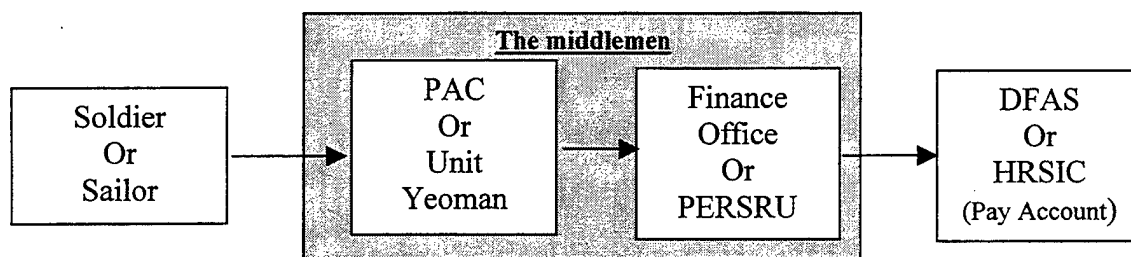
Figure 11. High-level representation of Baseline process

To better illustrate the three redesign alternatives, we use rich text pictures as presented in Figures 13, 14, and 15. The alternatives are discussed in the context of how each redesign alternative uses the transformation enablers (e.g., workflow, technology, and organizational change) described in Section A above to improve the MPDP process. To reduce redundancy, we only highlight differences between each alternative. We begin by discussing Alternative One and outline how it differs from the baseline. Then we discuss Alternative Two and describe how it improves on Alternative One, which is followed by a discussion of Alternative Three improvements. Finally we summarize the redesign enhancements for all three alternatives.

1. Alternative One

Alternative One, Figure 13, takes advantage of the following transformation enablers: workflow, technology, organizational and information availability. Workflow is used to accomplish each task where it makes the most sense, at the customer level. Three basic technologies are used to accomplish this: knowledge-based DSS, electronic forms, and email. Using a knowledge-based DSS the customer answers questions pertaining to the potential transaction. After answering the questions the customer is presented with the proper electronic form for the transaction. Electronic forms, such as the ones created by a company called FedSoft Corp, based in Fairfax, Virginia, are e-mailed to the finance office for processing. In the baseline process the PAC accomplished the tasks of determining the customer's needs, assisting with form preparation, and submitting forms to finance. The use of workflow and technology enablers eliminates the need for the PAC.

In Alternative One, to facilitate the process in the finance office, organizational enablers are used to create two person case teams. Each team has responsibility for servicing specific units. Each member on the team is a trained auditor and is empowered with the capability to upload documents to DFAS-IN. By aligning each team with specific units and providing upload capabilities to each member, one creates job enrichment and job satisfaction. Teams receive electronic documents e-mailed from their customers, code the transactions, and upload the information to DFAS-IN. Tracking measurement metrics such as accuracy statistics on each team can provide information to managers about a team's effectiveness and other statistics may help to identify training needs. Case teams provide task ownership, attach responsibility to task accomplishment, and allow members to see the job through from start to finish. This also creates a sense of mission accomplishment. Although the use of technology in this alternative is limited, the process is very different from the baseline. Case teams can have positive performance effects in terms of cycle time (and often cost), as a single case team eliminates the need for handoffs and inter-departmental coordination. [Nissen, 1995] Remember in the baseline there are three coders, an auditor, and an uploader. Only the uploader has the

capability to upload documents to finance. Also in the baseline coders coded any documents available. There is no sense of ownership of the product or task. Through the use of the enablers described above the customer now has good information early in the process and can perform the transaction himself without assistance from the PAC. This alternative is the first step at eliminating the middlemen (PAC and Finance).

2. Alternative Two

Alternative Two, Figure 14, uses the same enablers as one, but enhancement in technological enablers provides more functionality for the customer and eliminates the finance office case teams in Alternative One. Alternative Two enhances workflow by using an Intranet and e-forms with a front-end web page and a backend (local) database located at the finance office. The web page incorporates the DSS used in Alternative One to help the customer determine the correct form for a particular transaction. The local database contains a copy of the soldier's MMPA. Authentication, encryption, and digital signatures are used when customers access the web page and log in to conduct a transaction. This local database provides each customer with the ability to access his account in near real time. When he wants to conduct a transaction, he answers a series of questions, an e-form is displayed and only the fields pertaining to the transaction are accessible. When the customer submits the form the data are compared against his account on the local database. If the transaction is valid, a transaction confirmation is returned to the customer. If the transaction is not valid, the system returns a narrative reason why the transaction could not be processed at this time. Alternative Two, unlike Alternative One, prevents a customer from submitting transactions that are not valid. In Alternative One the customer could submit a transaction, and allotment for example, that was invalid. An example of an invalid allotment transaction would be a transaction to start a duplicate allotment. In Alternative One this could happen and not be noticed until it was rejected by DFAS-IN. In Alternative Two the use of a local database provides the soldier with near real time feedback.

In Alternative Two an organizational change at the finance office eliminates case teams and replaces them with a front-end finance web page, local database, and a system administrator. Currently there are many commercial off the shelf software and hardware

products which can be used to create an environment for Alternative Two. Software tools such as Cold Fusion can be used to create dynamic web pages and integrate a relational backend database. There are also enterprise resource solutions, developed by a company called Systems, Applications, and Products in Data Processing (SAP) for example, that focus on process integration and functional area integration. These products enhance the capability for single source data input. The transaction information entered by the customer at the web site never has to be entered again. It is converted into the proper format and processed against the local database. The system administrator uploads transactions and updates local databases nightly. The use of a local database allows the customer the ability to query his transaction history and account status, having almost perfect information prior to submitting a transaction. The customers, during in processing, would only report to finance to receive their user names and passwords. This alternative brings use another step closer to completely eliminating the need for the middlemen.

3. Alternative Three

Alternative Three, Figure 15, fully incorporates the Internet and distributed database technologies to create a virtual finance office. This virtual finance office uses web-based tools to process transactions for customers in near real time. This alternative requires DFAS-IN to maintain a web page accessible by customers from anywhere in the world any time of the day. In Alternative Three customers receive immediate notification when the transaction is processed. In this alternative customers access a web page with user friendly menus. Customers can check on the status of their accounts, retrieve and print Leave and Earning Statements (LES), and review their transaction history files. In the baseline, Alternative One, and Alternative Two, LESs are prepared at DFAS-IN, mailed to the finance office and distributed to each unit. For a customer to get pay information prior to the end of the month requires a special request. Using e-forms, the Internet, enterprise resource planning software solutions, and distributed database technology, the information input by the customer goes directly to DFAS-IN without human intervention, handoff, feedback loops, or human friction. This alternative results

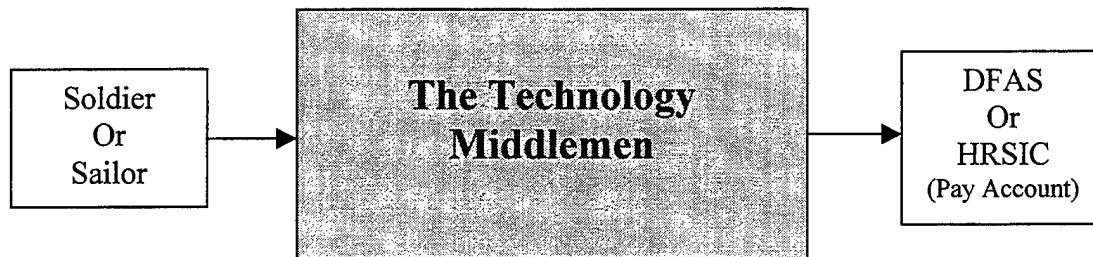in a new paradigm where the middlemen are replaced by technology. Figure 12 illustrates the new paradigm.

Figure 12. High-level Model of Redesign Alternatives (New Paradigm)

4. System Security Issue

Technology enablers are the centerpiece of redesign Alternatives Two, and Three. While technological enhancement may eliminate the middleman and add value to the customer, they also add risk to the process. Sending privacy information such as names with social security numbers over electronic medium has always been a concern for the military services. Incorporating electronic forms into workflow will require the use of digital signatures and data encryption to ensure privacy, integrity, and authentication of the customer. The Department of Defense (DOD) and Netscape are addressing security concerns. Last year DOD signed a deal with Netscape to provide a public key infrastructure. Because Netscape clients and servers support both FIPS-1 and FORTEZZA security standards, new DOD systems will be able to secure various levels of information, from basic e-mail messages to top-secret information on troop movement and battle strategy. [Hayes, 1998] Security technology must be incorporated into each redesign alternative.

5. Summary

Alternative One presents significant enhancements over the baseline using several transformation enablers. Alternatives Two and Three eliminate the PAC and finance office tasks. Using the concept of disintermediation these alternatives eliminate the middlemen using technology to accomplish tasks previously done by humans. Expert systems and decision support systems replace expert people. The tasks preformed by the

PAC (determining need, selecting document(s), and assisting with document preparation) and the finance office (coding documents) is done at the customer level assisted by technology (soldier or sailor). The concept is no different than on-line banking. Thus, moving the task closer to the source (the customer) will shorten the value chain, reducing cost and cycle time while improving the customer service.

Time consuming and costly reworks for incorrect documents will become obsolete. Smart (expert) systems will ensure that documents are correct or they will not get submitted. Replacing the middlemen in this process is simplified by the standardized way the MPDP is designed. There are very few complex decisions made in this process. Expert information (rules for entitlements and preparation of forms) is found in the Department of Defense Financial Management Regulation (DODFMR). The DSS in each alternative captures complex human knowledge about finance topics on a computer. The essence is in the interrelationship among the various items of information in so-called knowledge bases or finance manuals. This relationship is expressed as "if...then..." type of rules. The logical manipulation of logical operations is a somewhat primitive imitation of human thought processes, but it is well established and effective nonetheless.

By removing non-value added tasks one can eliminate the costs incurred from those tasks. As Lewis (1998) describes in the *Friction Free Economy,* by infusing technology and eliminating the middlemen one can increase the value added to the customer by making pay transactions more timely and less costly. Once disintermediation is applied, shortening the value chain is a natural outgrowth. The hierarchical structure supporting this process is reduced to the customer (soldier or sailor) and the supplier (DFAS or HRSIC) as shown in Figure 15. Disintermediation incorporated with a comprehensive approach to process redesign can dramatically improve process performance by eliminating non-value added tasks.

Alternative One

Electronic Forms
Email

DFAS-IN or HRSIC

Army
Fort Anywhere
or
Coast Guard
Customer

Case Team
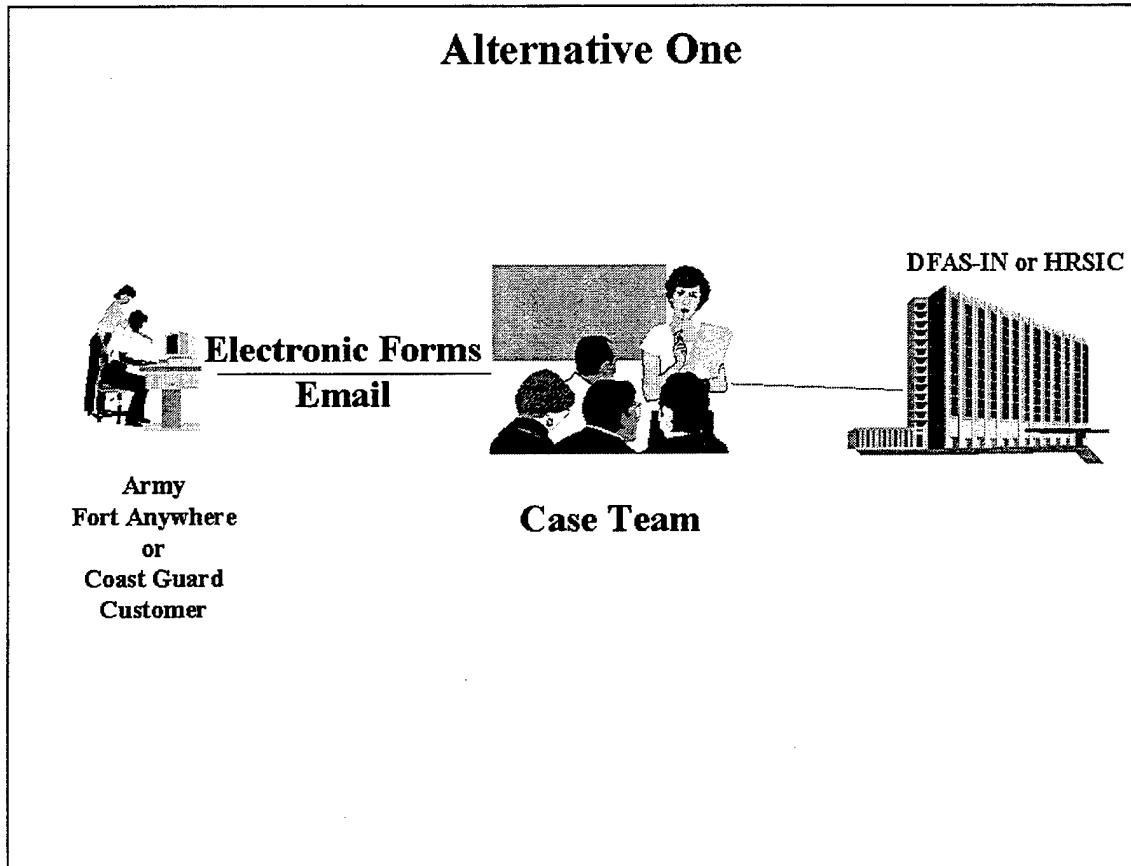
Figure 13. Rich Text Picture Alternative One

Alternative Two

Fort Anywhere

Fort Anywhere Web Page

Internet WWW

Fort Anywhere-
Local finance database

& System Administrator
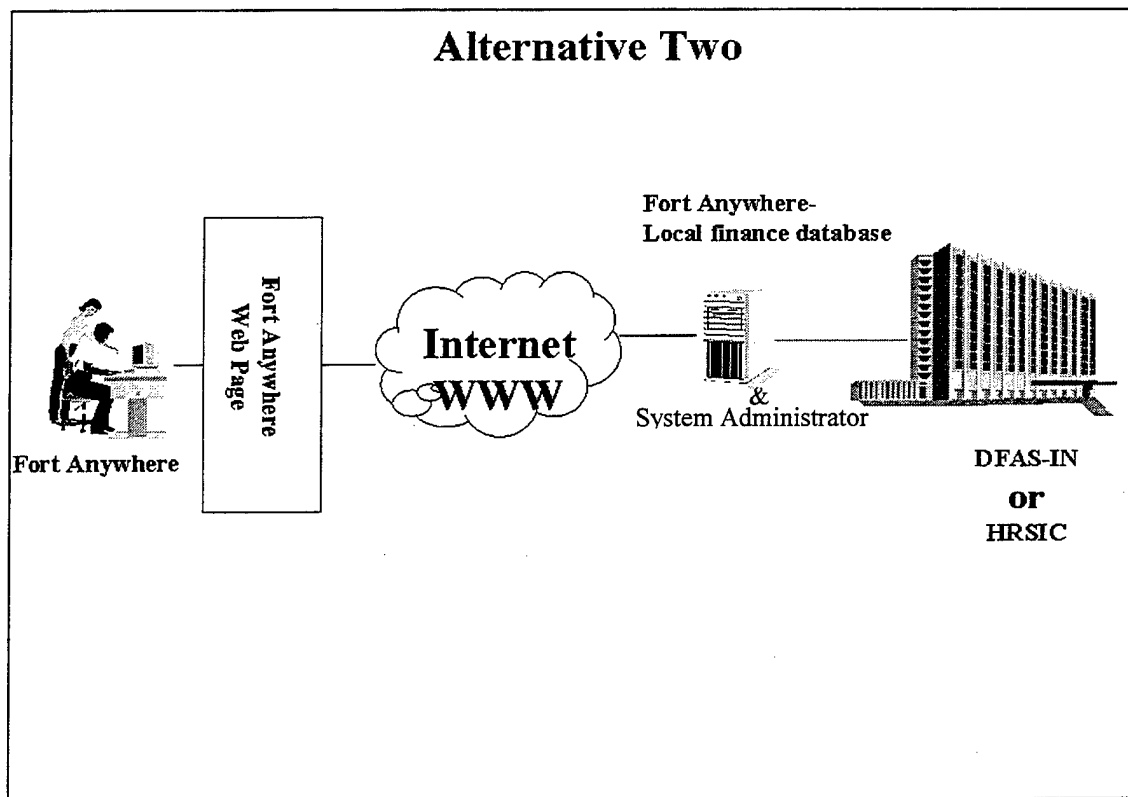
DFAS-IN
or
HRSIC

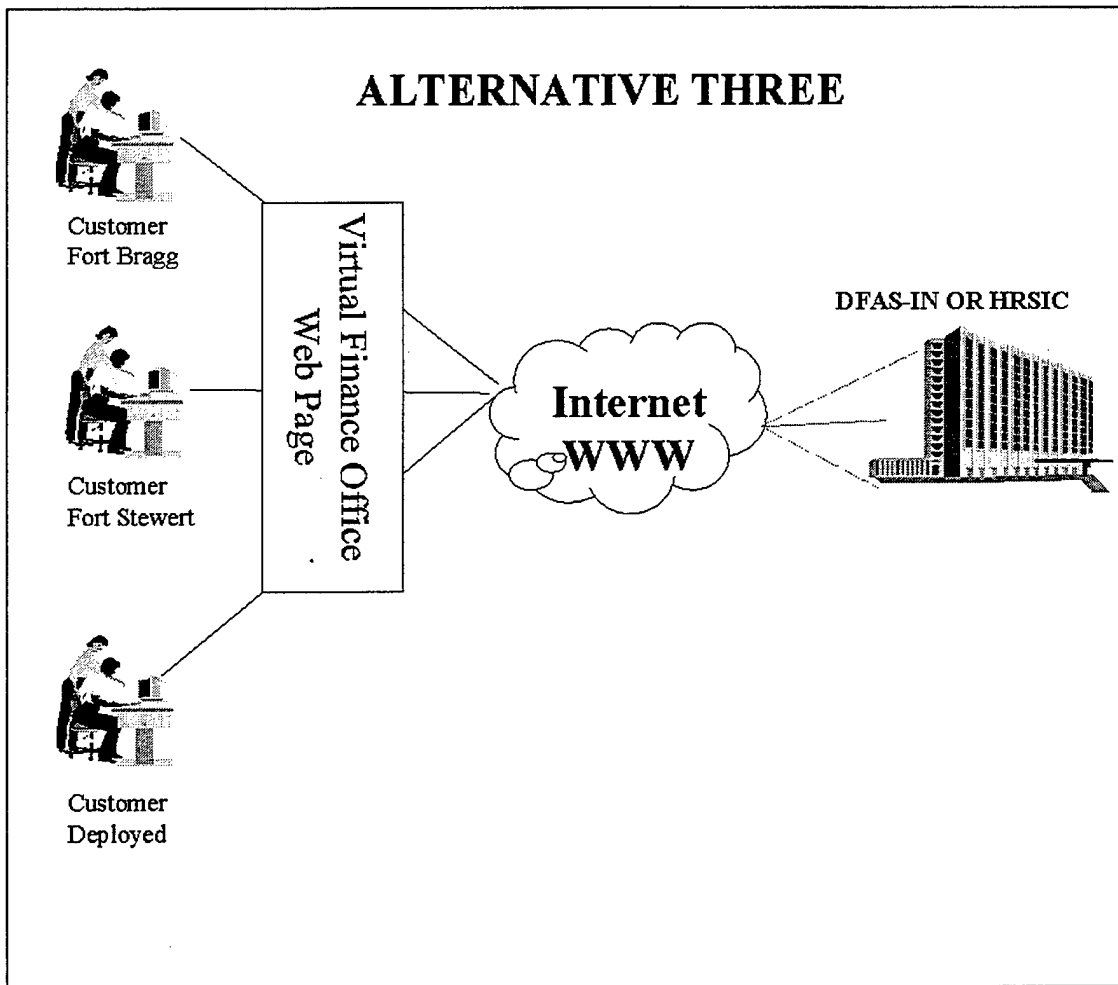**Figure 14. Rich Text Picture Alternative Two**

Figure 15. Rich Text Picture Alternative Three

C.   SIMULATION RESULTS OF REDESIGN ALTERNATIVES

When simulating the redesign alternatives we use the input values from Table 4. Each alternative assumes some delays, not calculated in this thesis, associated with network throughput and computer processing. We assume these delays are negligible when the network is operating properly and that they will not affect cycle time. Results are summarized in table 14.

The simulation results for Alternative One indicate an average cycle of nine minutes per document. Recall that the cycle time per document in the baseline process is 1.36 hours for the PAC. Using electronic documents and email in Alternative One we have eliminated the PAC function and effectively eliminated the associated cycle time. This represents a 100% improvement over the PAC process in each redesign alternative. The average cycle time for Alternative Two and Three can not be adequately measured, because it is dependent on the communication architecture and the latency associated with network throughput. But without human (middlemen) intervention, cycle time for this process step effectively approaches zero. Recall the baseline model of both the Army and the CG where the PAC clerk/unit yeoman only had a three or four hour window in the morning to get documents to finance to be processed for that business day. Each redesign alternative allows document submission on a 24-hour basis by the customer.

Each alternative introduces technological enhancements. Alternative One's introduction of workflow tools eliminates the labor cost and cycle time associated with the PAC process. The cost of the baseline process based on an eight-hour workday is approximately $11,880 per month. This amount is the aggregate cost of the PAC process and the finance process as shown in Table 7, Chapter III. Using these values one can see that Alternative One yields 47% savings in labor cost over the baseline.

In Alternative Two we calculate labor cost for a system administrator to maintain a local database and a web page for the finance office. We propose that the administrator be a military officer (or civilian equivalent) with a graduate education, at the rank of O-3/GS-12 (with 6 years) and with some finance experience. Using the 1999 military pay compensation table, we determine a cost of approximately $4,577 per month for an administrator. In Alternative Three we add the cost of one web master to manage the

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web page at DFAS-IN. DFAS-IN currently has system administrators who manage the database containing the MMPAs. We assume based on current service (DFAS Homepage) provided by DFAS that the communication and software infrastructure to facilitate this redesign alternative is minimal. Alternative Two and Three eliminate the cost associated with labor for the PAC process and the finance process by replacing them (the middlemen) with technology and can potentially yield a 61% savings over the baseline.

Although the initial overhead cost associated with software and hardware upgrades and training can be substantial, the automation infrastructure in most finance offices can facilitate easy migration from current systems to web based distributed network technology with minimal upgrades. This comparison illustrates that eliminating the middlemen in MPDP will result in significant savings in the cost of direct labor while decreasing document cycle time and increasing customer satisfaction.

Table 14 Extend Output Results of Redesign Alternatives

Measures	Baseline	Alternative One	Alternative Two	Alternative Three
Average Cycle Time per document	1hr 42min	9 minutes	Effectively zero	Effectively zero
Cost of labor per month	$11,880	$6263	$4,577 *	$4577 *

*Not calculated using EXTEND

D.   COMPARE REDESIGN ALTERNATIVES TO BASELINE PROCESS

KOPeR analyses of each alternative indicate a sequential process. However workflow enhancements have decreased the number of handoffs from .357 to 0.00 resulting in a 100% decrease over the baseline, for the three alternatives. Alternative One uses a simple DSS, electronic forms, and e-mail which is practical and easily implemented. This simple infusion of technology provides dramatic improvements over the baseline process. Recall that Alternative One uses technology to eliminate the PAC function, but maintains the finance office and reorganizes it into case teams. Alternative One does not allow the customer to verify the validity of his transaction prior to

submission. Therefore it is possible that the case team may have to send the document back to the customer because the transaction requested is invalid (i.e., trying to stop and allotment that doesn't exist). Consequently there is a limited decrease of 7% in the feedback fraction. This is remedied in Alternative Two and Three by providing web interface to a local database or directly to DFAS-IN respectively. These alternatives result in a 100% decrease in feedback friction over the baseline. This is due in large part to the workflow tools and web database interface technology that allows almost real time access to the customer's account. The three alternatives indicate a dramatic improvement, in information technology support, communication, and automation measures, over the baseline. Using KOPeR, comparative measures for each redesign alternative are presented in Table 15.

Table 15 KOPeR Comparative Measures

Measure	Baseline Army	Alternative One	Alternative Two	Alternative Three
Process Length	12	3	3	1
Process Handoffs	5	0	0	0
Process Size	14	3	3	1
Process Feedback	5	1	0	0
IT Support	7	3	3	2
IT Communication	1	3	3	2
IT Automation	2	3	3	2
Parallelism	1.167	1.00	1.00	1.00
Handoffs Fraction	0.357	0.0	0.0	0.0
Feedback Fraction	0.357	0.333	0.0	0.0
IT Support Fraction	0.5	1.00	1.00	2.00
IT Communication Fraction	0.071	1.00	1.00	2.00
IT Automation Fraction	0.143	1.00	1.00	2.00

V. SUMMARY, CONCLUSIONS, AND FUTURE RESEARCH

A. SUMMARY

This thesis examined how redesigning the Army and CG's MPDP could dramatically improve cost and document cycle time. Chapter II presented background information on the evolution of the Military Pay System and Business Process Reengineering. Chapter III discussed the tools used to analyze and redesign the Military Pay Document Process. It also provided simulation results as well as KOPeR diagnoses of the processes. Chapter IV examined redesign alternatives which dramatically improved cost and cycle time.

B. CONCLUSIONS

The KOPeR analysis of the "as-is" process indicates that the MPDP suffers from major pathology faults. These pathologies suggest serious performance implications. KOPeR shows that the baseline process is nearly sequential, and highly departmentalized with excessive rechecks. Measurement values for IT-S, IT-C, and IT-A revealed that, although IT-S is adequate, IT-C and IT-A are not. This indicates that some IT support is available, but is not paying dividends in terms of improved process performance.

Therefore each redesign alternative presented in this thesis enhances these shortcomings by eliminating non-value added tasks and combining tasks. Each suggested alternative yields an increase in process performance over the baseline. Alternative One reduces labor cost by 47% and cycle time by 90% (from 1.5 hours to 9 minutes per document). Alternatives Two and Three reduce labor cost by 61%, as a result of eliminating the middlemen, while effectively decreasing the cycle time to zero using technology to shorten the value chain between the customer (soldiers or sailors) and the supplier (DFAS or HRSIC).

In each redesign alternative, IT does not simply automate a flawed process, but it is used as an enabler to yield dramatic process performance improvements over the baseline process. We took a critical look at the tasks and processes associated with the MPDP, and asked the questions "Why are we doing it this way?" and "Can it be done better?" We concluded that by reengineering the MPDP to eliminate the middlemen and

radically changing the process, dramatic improvements in process performance could be realized. However, continued research into technology cost, training cost, new manning numbers, and implementation planning is necessary to realize the true benefit of these redesign alternatives.

C. RECOMMENDATIONS

The authors recommend that the Army and Coast Guard use each alternative as a building block, starting with Alternative One and incrementally increasing functionality to obtain the ultimate goal of the virtual finance office as illustrated in Chapter IV, Figure 15. An incremental development process is useful in systems engineering when all requirements are not known up front. Once Alternative One is deployed, there will be suggestions from customers and new requires that can improve the MPDP process. These suggestions can be implemented in Alternative Two and Three if necessary. The incremental approach allows users and customers the ability to take an active role in the development of a virtual MPDP.

The transition from the current MPDP to Alternative One may be easier for the Coast Guard than for the Army. The Coast Guard's finance office currently, as illustrated in Chapter IV, Figure 13, uses case teams when processing documents at the finance office. These teams are already aligned with specific units. The Army, on the other hand, uses individual coders who have no association or direct relationship with particular units. Implementing the first alternative will require an adjustment period for the Army but can be accomplished with minimal impact on current operating procedure while making dramatic improvements in process performance. Once Alternative One is implemented and proven successful, Alternatives Two and Three are simply functional improvements to the first alternative.

The key to the incremental approach is to establish a time line for completing each alternative upgrade. Sticking to this time line will require a dedicated team throughout the planning and implementation phase of the redesign project.

D. TOPICS FOR FUTURE RESEARCH

The information presented has the potential to dramatically improve the MPDP using technology like e-forms, intranets, distributed database technology, DSS and expert systems. The authors recommend four major fields of study for future research before implementing any of the alternatives presented in Chapter IV. These areas are not sufficiently addressed in this thesis due to time and scope limitations.

1. Technology Cost

Technology cost of the alternatives suggested in Chapter IV is an issue that should be addressed. Consider possible upgrades to the communication infrastructure to create a larger bandwidth capability for transmitting documents and information faster and the cost associated with software and hardware upgrades. Addressing the cost for hardware and software upgrades, Gary Eldridge states that "A self examination should be done that looks at six aspects of IT operations: employees, internal operations, financial, innovation and learning, customer value and the value of IT investment." It is imperative that the Army and Coast Guard evaluate their current IT technology and then research what the cost per unit for each alternative will be to efficiently implement the Virtual Finance Office.

2. Security Issues

Security will be a major issue in the implementation of each alternative leading up to the Virtual Finance Office. Different technology like data encryption and digital signatures must be looked at in an effort to securely transmit privacy information across an electronic medium such as the Internet. DOD and Netscape's deal to provide a public key infrastructure, which provides each military user with a software identification card - complete with user name and access privileges will go a long way in the evolution from the current MPDP to a virtual finance office. The result of the security measures taken by DOD and Netscape will allow users to access a range of enterprise-wide applications and information while eliminating the need for traditional DOD stovepipe communication architecture. John Menkart, the director of federal sales for Netscape Government Group, said in a recent article in DoDIT that "Once the system is fully in

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place DOD will be able to expose even the most mission critical [information] over the Internet and still assure that only people that have permission to access it will be doing so". [Hayes, 1998] According to Hayes, the majority of everyday business processes will be automated and web-enabled. These processes include but are not limited to product ordering and delivery, travel voucher settlement, accounting, finance transactions, and official communications. The bottom line, says Menkart, is that the military will be able to take the best possible advantage of its system to get and transmit information between customers (soldiers and sailors) and suppliers with an extremely high degree of security.

3. Training Cost

Another major stumbling block for projects, which involve new technology, is the user's ability to effectively utilize the product. Infusing new technology will present some training challenges. Soldiers and sailors will require training on the use of electronic forms and digital signatures while finance personnel will need training on workflow tools, web technology, and database maintenance. The cost of training and maintenance represents a major part of the life cycle cost of most projects. Therefore the use of Commercial off the Shelf (COTS) solution are critical. COTS equipment can present users with common tools which they currently use; therefore users require less training to become proficient. The use of COTS equipment allows one to take advantage of the research and development dollars of the commercial world and can help limit maintenance cost. If users aren't properly trained the project is destined for failure. Secure funding for adequate training is essential prior to beginning the redesign project.

4. New Manning Numbers

The Army and Coast Guard will need to examine new manning numbers for their financial communities. Bitzer suggests that improved worker productivity, electronic communications, and the automation of work routing, tracking and completion result can reduced manpower requirements. Extensive realignment of both organizations along with the implementation of new rules and regulations will be needed in each redesign effort. Dr. Sharon Caudle notes that many successful government organizations are adjusting their organizational structures and reporting relationships to better support process

redesign initiatives. However, major change will not happen without top management commitment and support. This redesign project will require the senior leaders in both services' financial communities to become intimately involved.

Currently the Army uses a 19 plus person detachment to provide pay support to approximately 6000 soldiers. The primary responsibility of this detachment, as described in Chapter III, is to provide pay support using the MPDP. By implementing the alternative suggested in this thesis we propose that a 19 plus person detachment in its current capacity is no longer needed. A smaller more dynamic organization can result from the suggested redesign alternatives. Such a major paradigm shift promises to be a bit of a culture shock for people interested in maintaining their "rice bowl". But the benefits, in term of cost saving, cycle time, and customer service, that come from eliminating non value added tasks easily out weigh the temporary adjustment difficulties. The CG's organizational structure is similar and will face similar challenges.

5. Implementation Plan

A true implementation plan for any of the alternatives listed in Chapter IV must consider the technology cost, training cost, and manning changes. The authors visualize a seven-phase approach for the implementation of the new MPDP process. The seven phases of the implementation plan would include marketing, contracting, prototyping, installation, testing, training, and the rollout of the new system. These seven phases, we believe, are not mutually exclusive and some may overlap each other. Some of these phases will be ongoing throughout the project.

E.   FINAL THOUGHT

This is a quote taken from an executive summary. It expresses the need to reengineer processes and eliminate non-value-added tasks, rules, and regulations to increase quality and reduce cost in the federal government.

About 10 years ago, two foresters returned from a hard day in the field to make plans for the coming week. Searching for a detail of agency policy, they found themselves overwhelmed by voluminous editions of policy manuals, reports, and binders filled with thousands of directives.

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One forester recalled the very first Forest Service manual- -small enough to fit into every ranger's shirt pocket, yet containing everything foresters needed to know to do their jobs.

'Why is it that when we have a problem,' the other forester asked, 'the solution is always to add something--a report, a system, a policy--but never take something away?'

The first replied: 'What if . . . we could just start over?' [Executive Summary, 1993]

Reducing cost and improving customer service in the government will require a systematic approach to process redesign with a focus on dramatic change. The alternatives in this thesis represent dramatic change, capable of increasing process performance and improving customer service. The focus is to eliminate non-value added processes through a systematic redesign approach. Using this systematic approach, redesign alternatives are developed for the MPDP, which if implemented can result in the reduction of value chains, lower cost, shorter document cycle time, and an increase in the quality of customer service.

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